Published Apr. 27, 1943

Serial No. 106,911

ALIEN PROPERTY CUSTODIAN

MANUFACTURE OF ARTIFICIAL TEXTILES

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Application filed October 21, 1936

My invention relates to the manufacture of artificial textiles, and has for its object, in the first place, to provide a spinning process which allows of obtaining products having both in the dry and more especially in the moist state, mechanical properties which are materially superior to those which have been hitherto obtained, and approximate very closely, for instance, in the case of textiles of cellulose obtained from regenerated viscose, to the mechanical properties of cotton.

Although the process of the present invention is applicable to the various processes in the manufacture of artificial textiles, it has been more particularly investigated and is herein described with reference to the viscose process.

A further object of the invention is to provide a device for carrying the said process into effect.

The above mentioned enhanced mechanical properties of textiles, together with the correlated property of a smaller degree of swelling in passing from the dry to the moist state, are derived from a peculiar structure owed to the method of spinning according to the invention, said structure being characterized, in addition to a certain degree of directional arrangement of the micelles, also and especially by the presence of residual internal tensions of increasing strength from the centre towards the periphery of the cross section of each single filament of the textile.

The process according to my invention consists broadly in subjecting the filaments to a continuous, gradual stretching during the whole or a great part of the period of time necessary for their complete formation in the course of spinning, that is to say for each filament to undergo the change from the initial state of a colloidal solution enclosed in a thin film, as assumed at the issue from the holes in the spinning nozzle, to the final state of thorough coagulation and setting, as proved by the fact that when freed from the stretching device the filaments would have none or a very little tendency to shrink.

In order to better explain the principle of the invention let each filament be considered as ideally composed of concentric elementary layers successively formed by the progression of the coagulation from the surface towards the centre of the filament; then it will be understood that on account of the gradual stretching action being simultaneously exerted upon the layers, each of these will not only be formed under such conditions of tension as are generally considered as favourable to the directional arrangement of the micelles, but will also undergo a total longitudinal deformation which will be respectively less or greater that that of the preceding or following neighbouring layers, such deformation giving rise in the finished product to the aforementioned internal residual tensions of increasing value from the centre towards the periphery of the cross section.

It is also evident that the increase in the strength of said residual tensions, from the centre to the periphery, and consequently the physical properties of the thread, will depend upon the total amount of longitudinal deformation, and that it will therefore be possible by a suitable choice of the percentage of stretching, to control the tensile strength and correlatively the elongation of the finished products, in order to suit the particular requirements of their use in the manufacture, particularly according to whether it is desired to obtain continuous filament textiles (rayon) for which the elongation should not be reduced below given limits, or short fibre textiles (staple fibres) as obtained by cutting the bundle of filaments forming the thread in short lengths, for which textiles it is desirable to obtain high tensile strength even with a low elongation, as in the case of natural vegetable fibres (cotton for instance).

While the possibility of increasing the tensile strength of artificial textiles by subjecting the filaments, during the spinning operation, to a certain degree of stretching has already been considered in several methods of spinning artificial silk, there is no evidence that any reference had ever been made either to the desirability of exerting the stretching action gradually during the comparatively very long time required for the filaments to reach the final state of setting or to the correlated advantage of rendering them capable of supporting a comparatively very high percentage of stretching.

On the contrary, any such correlation between stretching and coagulation appears to be precluded, in all the known methods, considering the exceedingly short duration of the stretching action which reaches at the maximum a few seconds, for the usual spinning speeds, this action being exerted on lengths of thread of not more than a few metres.

Considering for instance the viscose process, wherein usual speeds of 55–65 metres per minute are used, since the stretching devices of known methods generally act on lengths of thread of not more than two metres, the stretching action is completely ended within two seconds at the maximum, whilst according to the invention, in the particular case which has been cited below, as an

example, the stretching action is gradually exerted on a length of thread as great as 38 metres, corresponding to a duration of about 40 seconds, say twenty times more than in known methods. This striking difference, together with that concerning the amount of stretching, which generally is limited to 30% in the known methods, whilst it reaches according to the present invention, in the example cited below, for instance, the unprecedented value of 70%, clearly define the novelty of the invention over the previously known methods.

From the foregoing it will be understood that in order to obtain the best results the duration of the stretching action shall be checked according to the elements affecting the duration of the coagulation, that is the count of the filaments and the physico-chemical properties both of the colloidal solution and the coagulating agent. In the case of the viscose, for instance, the duration will depend upon the cellulose and soda contents of the viscose and its degree of ripening, as well as upon the nature and concentration of the spinning bath. Considering particularly the great number of formulae which have been proposed for spinning baths, it will be understood that it would be almost impossible to give exact limits for the duration; however, a duration of stretching of from 15 to 60 seconds appears to cover all the conditions that can be industrially met with.

As to the amount of stretching which, as previously stated, allows of controlling the correlated values of tensile strength and elongation of the thread, the same may easily be chosen, in the case of the viscose process, between 40% and 80%, the higher value referring to the production of short fibre textiles similar to natural vegetable fibres such as cotton.

The device for carrying out the process of the invention consists substantially of a kind of winder frame, of a particular structure, on which the thread while being wound in helical turns is at the same time subjected to progressive stretching; this winder frame is interposed, in the spinning machine, between the spinning nozzle and the thread receiver (bobbin, centrifugal box, conveyor belt or other means), so that the thread, unwinding itself from the device after having travelled through a certain number of turns, passes to the receiver.

A preferred embodiment of this device is hereafter described with reference to the attached drawings, in which:

Fig. 1 is a side view of the device partially in section through its longitudinal axis;

Fig. 2 is an end view along the axis of the device;

Fig. 3 is a perspective view of the device, showing the thread wound on it. and

Fig. 4 is the representation of a detail.

The device comprises a hollow drum generally indicated in the drawing by the reference A, formed of two parts substantially in the form of discs **1** and **2** joined together so as to form a single piece, the second of which is fitted with a long hollow spindle **3**, coaxial with the drum mounted, with the interposition of a bronze bush, in a bored seating in a frame B. The drum A is thus free to revolve about its axis x—x, being driven in the following manner. The periphery of the drum is provided with a toothed ring **4**, which engages with a pinion **5**, carried by a spindle **6** whose axis is parallel to x—x, mounted in a bearing **7** formed in the frame B. The opposite end of the spindle **6** carries a bevel pinion **8** which engages with a second bevel pinion **9**, keyed to a shaft **10** whose axis is at right angles to the axis x—x of the device. This shaft runs right along the spinning machine parallel to the series of spinning nozzles, and may receive the movement in any conventional manner by the drive of the machine itself. The shaft **10** transmits the rotary motion to the drum A through the gears just described, and so on in exactly the same manner for each of the devices relative to the different spinning nozzles in the machine.

The drum A acts as a support for eight cylindrical rollers, a_1 . . . a_8, pivoted on it and whose axes are at an angle to the axis x—x and spaced at equal intervals around a circumference. These axes meet a plane perpendicular to the axis x—x, on the front of the drum A, whose trace is indicated in fig. 1 by m—m, at points at 45° one from another on a circumference having its centre on the axis x—x; they are, however, askew with regard to the axis x—x, being tangential to an imaginary cylinder whose axis is the axis x—x and whose base is the above mentioned circumference, and form with the generating lines of said cylinder an angle α.

The rollers a_1 . . . a_8 are mounted overhanging from the drum A by means of end pins **11** which are free to revolve in bearings **12** and **13**, provided respectively in the front part **1** and in the rear part **2** of the drum. Of course the axes of these bearings are askew with respect to the axis x—x in the way described above; it should, however, be noted that the axes of the rollers a_1 and a_8 are shown in fig. 1 in a conventional manner, for the sake of simplicity, as if they were contained in the plane of the drawing. It should further be noted that the pins **11** for the rollers a_4 and a_2 are not shown in the drawing in order to render it clearer.

Each of the pins **11** is fitted with a toothed wheel **14** which engages, through a suitable helical gearing, with a central gear wheel **15**; this receives, in consequence of the rotation of the drum A, a rotary motion in the same direction, but at a slower speed, through the effect of the following gearing. The gear wheel **15** is keyed to a spindle **16** which is free to rotate within the hollow spindle **3** and carries a gear wheel **17** keyed to its end projecting from the hollow spindle **3**. This latter also carries, on its end near the gear wheel **17**, a toothed wheel **18**. The gear wheels **17** and **18** engage respectively with two other gear wheels **19** and **20**, locked together but both free to rotate about a fixed stud **21** carried by the frame B. If the ratio of transmission between the gear wheels **17** and **18** is suitably chosen, so that it be less than unity, the gear wheel **15** will turn, as has been mentioned, in the same direction as the drum A, but at a slower speed.

Through the effect of the engagement between the gear wheels **14** of each single roller a and the central gear wheel **15**, the rollers, besides being driven round as a whole with the drum A, each receives a separate rotating movement about its own axis in the same direction. The nearer the rotational speed of the gear wheel **15** is to that of the drum A, the slower will be the individual rotation about its own axis of each separate roller, and the same may be suitably set by varying the number of teeth in the gear wheels **17** . . . **20**. The rollers a are suitably covered with rubber or other suitable material.

In the operation of the device the set of rollers a carried by the drum A and revolving with it

may be regarded as a winding frame, on which the thread coming from the spinning nozzle in the form of a bundle of filaments is caused to wind itself. It is evident that a consequence of the simple rotation of the device around the axis x—x the thread would tend to wind itself according to a polygon lying in a plane at right angles to the said axis. However, through the effect of individual rotation of each of the rollers a, it will come about that the thread, along the small arc it embraces on each roller, will be drawn by the movement of the roller along a circumference at right angles to the axis of the roller and passing through the point at which the thread makes its first contact with its surface. Owing to the obliquity of the axis of the roller with respect to the axis of rotation of the device this displacement of the thread will therefore have the effect of causing the thread to leave the plane perpendicular to the axis of the device. in a direction depending upon that of the obliquity of the roller. The direction of such obliquity having been suitably chosen, the turns of thread will be displaced starting from the side next the drum A towards the free end of the rollers. This will result in causing the thread to assume, in general, a helical direction, so that there will be formed on the system of rollers a series of turns side by side, spaced one from the other a small distance and carried on the device as on a winding frame (Fig. 3). Beginning from the last turn towards the right, the thread r will be led to the receiver, for example, the box of a centrifugal spinning machine, for the final winding.

The direction of the rollers a, diverging from the axis x—x towards their free ends, is such that their envelope may be considered as roughly trunco-conical; therefore the length of a helical turn wound in a polygon on the set of rollers will increase progressively as its distance from the drum A increases.

It must be considered that each turn of thread, after it has been wound on the roller system, by the effect of the general rotation of the device, near the inner end of the rollers (f in Fig. 3), is gradually shifted along these, towards their outer end by the effect of their individual rotation; at the same time, owing to the general rotation of the device a new turn is wound on at every revolution, beginning at f, and another is cast off. at r. In this operation the adherence between the thread and the surface of the rollers is, however, such as substantially to prevent any slipping of the turns at their points of contact, and as a consequence each turn, in passing from the point in which winding on the device begins, to the point where it is cast off, will be obliged to increase its length by a certain amount depending upon the degree of divergence between the rollers.

The device thus, according to the process of the present invention, subjects the filaments of the thread, over a considerable length, such as the total length wound on the device, to a gradual and continuous stretching process, the thread being first wound on the device in its initial state of formation immediately after it leaves the spinning nozzle, and being cast off the device in a state of complete coagulation and setting, or nearly so.

As a demonstration of the results which can be attained with the process of the present invention, there are given below by way of example the data drawn from comparative tests made on textiles produced according to the invention and according to known processes.

From a viscose prepared in the usual way containing 8.1% of cellulose and 6.9% of soda, having a viscosity of 32 (ball viscosimeter), index of coagulation 13 (Hottenroth), issuing from a spinning nozzle with holes of 80 microns diameter, immersed to a depth of 18 cm. in a spinning bath containing 11.5% of sulphuric acid and 27% of sodium sulphate, threads were produced composed of elementary filaments of 1.5 den. grade, in the following two ways, namely

(a) Under ordinary conditions of spinning, that is to say, winding the thread issuing from the spinning nozzle directly on to a bobbin, and

(b) Following the process of the present invention, that is to say interposing between the spinning nozzle and the bobbin the device described, and winding the thread on it. With the actual device used in the cited case, 70 turns of thread were wound on, equal to a total length of about 38 meters of thread, which remained on the device for a period of about 40 seconds, and with a total stretching of 70%.

Samples of the threads obtained respectively under the condition (a) or (b) where subjected to tensile and elongation tests; they were found to have the following mechanical properties.

Samples		(a)	(b)
Specific strength in dry state	gr/den.	1.65	2.75
Specific strength in moist state	do.	0.68	1.60
Elongation in dry state	per cent.	24	10.5
Elongation in moist state	do.	43	15

While these figures are quoted as an example, solely with the object of giving an idea of the effect deriving from the application of the process, it is to be understood that further improved results may be obtained by suitably varying the physico-chemical properties of the viscose and of the spinning bath. It will be also understood that the increase in tensile strength, with the consequent decrease in elongation, may be suitably controlled, limiting it in the case of rayon, in such a manner as to suit the mechanical properties of the thread to the requirements of its various uses (weaving, knitting, fabrics for pneumatic tyres etc.) while amplifying it in the case of short fibre textiles, thus bringing their properties into line with those of natural textiles of vegetable fibres, such as coton, which usually show a high degree of tensile strength with a low degree of elongation.

An idea of the mechanical properties of threads spun from artificial filaments previously cut to short lengths, as obtained by the methods known heretofore and the method of the present invention, respectively, in comparison with mechanical properties of a thread spun from best vegetable fibres can be acquired by an inspection of the following data. Threads of the same count (English count 20) were spun respectively from: (1) American middling cotton; (2) the best short fibre artificial textile material, 1.5 den. 32 mm. at present manufactured in Italy by cutting in the wet state bundles of filaments obtained under similar conditions to (a) in the previous example; and lastly, (3) the same artificial textile material, but produced under conditions identical with those cited in (b), in the foregoing example.

Samples of each of the above threads were subjected to tensile and elongation tests, and the fol-

lowing average mechanical properties were ascertained.

Samples		(1)	(2)	(3)
Breaking length	dry ... meters	11.700	8.600	14.200
	moist ... do	13.200	4.400	10.100
Elongation	dry ... per cent	6.9	11.6	9.8
	moist ... do	8.7	13.3	12.3

Also in this case the breaking lengths given for the sample (3) are susceptible of further increase.

It must be understood that the object of the present invention is, in the first place the process which has been described, and that this process can be carried out, without departing from the scope of the invention, by any device or apparatus different from the one described, provided it allows of the execution of the process in the manner described.

The device for carrying out the process of the invention, as has been particularly described and illustrated, also forms one of the objects of the invention, and it must be understood that its constructional form may be even considerably altered without going beyond the scope of the invention.

The shape of the rollers, in particular, may be other than cylindrical, with a view to obtain the desired clearance between the successive turns of the winding and consequently the desired rate of stretching of the thread at different points along the rollers. The rollers may be conical, for instance, or they may be shaped as represented in fig. 4, wherein the outline of the portion from D to E, near the inner end of the roller, is an arc of circle while the subsequent portion from E to C is cylindrical. This shape allows of a stretching at decreasing rate being obtained, such as has been found to be convenient in the practice.

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PUBLISHED APRIL 27, 1943. BY A. P. C.

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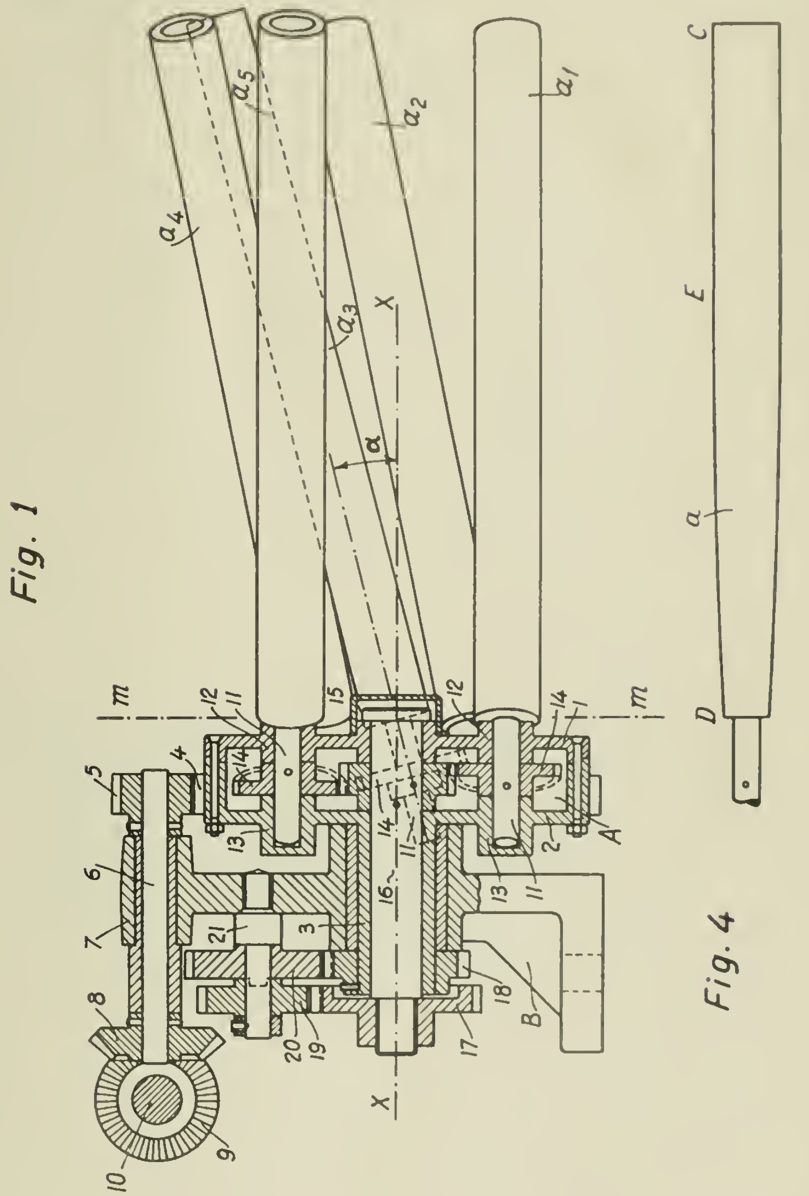
MANUFACTURE OF ARTIFICIAL TEXTILES

Filed Oct. 21, 1936

Serial No. 106,911

2 Sheets—Sheet 1



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APRIL 27, 1943.
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MANUFACTURE OF ARTIFICIAL TEXTILES
Filed Oct. 21, 1936

Serial No.
106,911
2 Sheets-Sheet 2

Fig. 2

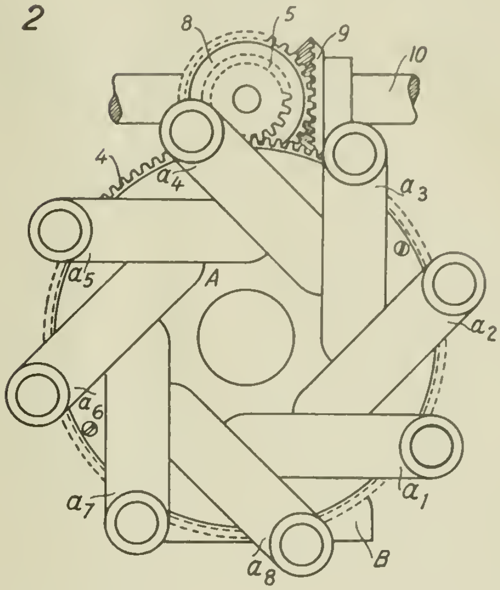
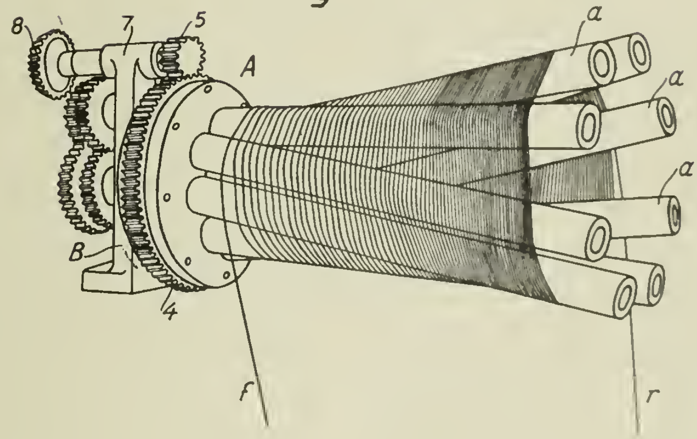


Fig. 3



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Published Apr. 27, 1943

Serial No. 113,559½

ALIEN PROPERTY CUSTODIAN

METHOD OF AND PLANT FOR MELTING REFRACTORY MINERALS IN REVOLVING-TUBE FURNACES

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Application filed December 1, 1936

The invention concerns a method of and a plant for melting glass silicates, other substances that are plastic when heated, and refractory minerals, especially oxides, by means of a revolving-tube furnace the drum of which rotates so quickly about its longitudinal axis that the charge to be melted is spread approximately uniformly on the interior surface of the drum. In the known devices of this kind, the said drum is horizontal or slightly inclined, and one of the drum ends has a burner the heating flame of which flashes into the rotating drum in such a way as to impinge on the charge on the interior drum surface. By impinging on the charge, the flame gives, however, rise to turbulent currents and whirls in the drum, which develop dust and thus retard the process of melting the charge.

The said disadvantage is overcome by the invention, according to which the heating flame is so directed into the melting chamber that whirls are avoided and the heat of the flame is transmitted to the charge by radiation only. This novel proceeding shows better results particularly in the treatment of refractory oxides of the kind used for making special technical objects, for instance quartz glass, sintered corundum, etc. Using the heat-technical preheating methods known per se and, particularly, supplying liquefied air or oxygen to the source of heat is especially advantageous. It is surprising that using oxygen and guiding the flame centrically yields much better results than making an oxygen flame impinge on the material to be melted, as has been done so far, this improvement being due especially in quartz melting to a decrease of the very disturbing evaporation of the said material. To obtain an effective radiation of the very hot flame produced, so that a transmission of intense heat can take place without the flame impinging on the charge, it may be convenient to increase the radiation capacity of the flame by adding to this flame a body not impairing the melting process, for instance fine charge dust, the exceedingly high temperatures thus available entailing the desired rapid and uniform physical and physo-chemical transformations.

In melting quartz, it is especially expedient to considerably increase the speed of rotation in such a manner that the radial centrifugal pressure increases artificially the pressure on the melting or pasty content of the drum. The idea underlying the said increase in pressure, to which not only the superficial but also the lower layers are subject, is to counteract the evaporation in a technical simple manner without the necessity of augmenting the gas pressure in the combustion chamber, which is exceedingly practical and constitutes considerable technical progress in quartz technology. This new proceeding naturally increases considerably the tensile strain sustained by the drum, which, nevertheless, can be remedied without difficulty, because the strain concerned remains within the limits admissible for the construction material concerned, for instance steel plate.

The method is carried into practice, as usual, by introducing the charge into the drum continuously or by steps and transforming this charge to a homogeneous batch. The molten batch is not permitted to flow out slowly but made to leave the drum very quickly at one and the same time. This proceeding is especially favourable in the case of refractory material, since it avoids losses due to the cooling of a comparatively thin jet of molten material leaving the drum and thus prevents the material from solidifying before the subsequent forming process takes place. The molten, and very hot, material is transferred very quickly from the furnace into a stationary receiver, in which it is kept at a high temperature. The molten material is formed in this receiver in the usual manner, for instance by blowing, pressing etc., eventually at the said temperature or at a temperature above that of the surroundings. The latter proceeding permits a better treatment and prevents undesired losses of heat. Oxides of the purest kind, which are known to have very narrow limits of softening, can, accordingly, be melted and treated comparatively easily and economically. It is especially economic to at least pre-form the molten material in the said manner and to continue forming it in a chamber less intensely heated.

A plant having a revolving-tube furnace for carrying the method into practice has, conveniently, a burner which can be fed according to circumstances with suitable gas, oil and other combustibles and which is so positioned that the heating flame is directed into the drum centrically and axially. Also electric heating can be used, but it is to be considered that thermal heat is cheaper. Respecting the feeding and directing of the flame and the form of the burner it has to be borne in mind in the case of the method in question that turbulent currents and whirls are to be avoided as much as possible in order to prevent creation of disturbing dust. On account of the high speed of revolution of the drum, it is advisable to protect the drum by means of an armour resisting high internal pressures. The

apparatus is considerably improved by a device for discharging the drum completely at one and the same time, for instance a tipping mechanism by means of which a drum cover and burner and a heated receiver for the molten material can be connected to the drum alternatively. The receiver conveniently consists of a lower and an upper part, the upper part having a device for heating different zones of the interior of the receiver to differently high temperatures. This receiver can be used in such a manner that the molten material in the furnace is emptied into the highly heated part and treated at least partly in the parts heated less, for instance by blowing in hollow forms, the resulting semi-manufactured products being finally formed outside the heated space. The chambers in the two principal parts of the melting plant, namely the melting drum and the receiver, can be constructed according to particular conditions of manufacture, it being naturally supposed that the principle is observed that, subsequently to having been melted in continuous rotation, the entire content of the furnace is transferred quickly, without any cooling, into the receiver in which it is to be formed.

To accelerate the evacuation of the drum, it may be expedient to tip the drum to an approximately vertical position. The position of the drum in the process of evacuation is subject to economical considerations. If the heating temperature is increased sufficiently, any fusible material can be given such a liquid state as to be removable from the interior of the drum simply by gravity and so quickly that no detrimental cooling can take place.

The material molten in the plant can be fashioned economically to technical objects, for instance crucibles, hollow bodies of various descriptions, rods, as well as to any kinds of fused, rolled and flat articles. These latter articles can be produced very advantageously by transferring the highly heated material from the lower part of the receiver direct into casting or welding devices. The molten material is of uniform quality and, on account of its high temperature, can be treated more easily than that produced according to the methods known so far.

The accompany drawing illustrates a constructional example of the invention in part-sectional elevation.

1 is a steel-armoured drum the interior wall of which is lined with fire-proof material **2**. The drum **1** is so mounted in a sleeve **4** as to be rotatable about its axis on two ball bearings **3**. To the sleeve **4** are fixed trunnions **5** mounted in stands **6** in such a manner that the sleeve **4** is rotatable about an axis at right angles to the longitudinal axis of the drum **1**. The sleeve **4** is provided with an electro-motor **7**, and the drum **1** has a ring of teeth **8** connected to the electro-motor **7** by means of an intermediate gear **9**. The one end of the drum **1** is covered with a plate **10** in which a burner **11** for a mixture of oxygen and suitable gaseous combustibles is so disposed that the flame **12** is directed into the drum centrically and axially. The other end of the drum **1** is connected to a tube **13** lined with fire-proof material. **14** and **15** are the lower and the upper part, respectively, of a receiver. In the upper part **15**, which is interchangeable, is provided a tube **16** for the introduction of a heating flame and a tube **17** for the exit of the waste gases.

The material to be melted, for instance quartz sand, is charged into the drum aperture provided with the waste-gas tube **13**, and the drum **1** is rotated very quickly by means of the electro-motor **7**. This rotation entails that a uniformly thick layer of quartz sand spreads on the interior surface of the dum **1**. Subsequently thereto, the flame **12** is introduced into the drum **1**, and fine dust is added to the gases ejected by the burner **11**, this fine dust increasing the heat radiation of the flame **12**. This radiation of heat causes the quartz sand to melt, and the quick rotation of the drum **1** effects that the molten layers are under a high centrifugal pressure and that the evaporation is counteracted considerably. As soon as the molten material is sufficiently soft, the plate **10** and burner **11** are removed, the speed of the electro-motor is lowered, and the drum **1** is tipped into the position **1'** indicated in the drawing by dash-lines. When the drum **1** assumes this tipped position, the drum aperture from which the burner **11** is removed connects to the upper part **15** of the receiver, which had been heated to a corresponding high temperature. The content of the drum evacuates into the receiver, the heating of which is being continued. In this receiver, whose upper part **15** may be divided into two differently heated zones by means of suitable walls, the softened material can be preformed. After having been evacuated completely, the drum **1** is tipped back into its original position, and the plate **10** and burner **11** are again connected to the drum, the plant now being ready for the melting of another charge.

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PUBLISHED

APRIL 27, 1943.

BY A. P. C.

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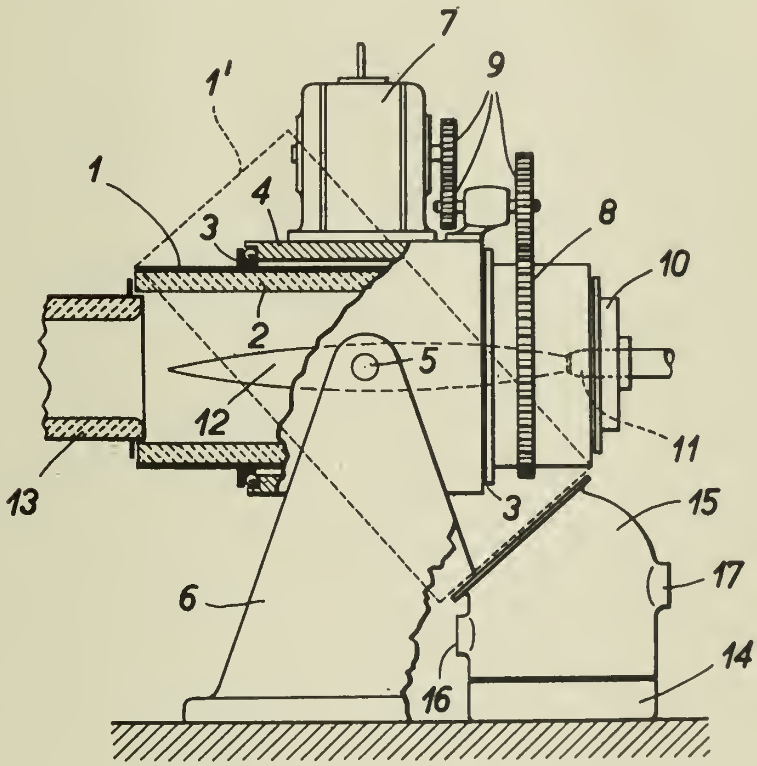
METHOD OF AND PLANT FOR MELTING REFRACTORY MINERALS IN REVOLVING-TUBE FURNACES

Filed Dec. 1, 1936

Serial No. 113,559½



Inventor:

Published Apr. 27, 1943

Serial No. 125,892

ALIEN PROPERTY CUSTODIAN

PRODUCTION OF THIN PERFORATED SHEETS OF GLASS OR METAL

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Application filed February 15, 1937

This invention relates to a method of producing thin sheets of glass or metal, provided with uniform holes of very small diameter, such as are used for example as spinning nozzles.

It is known to produce small holes in glass by fusing platinum wires individually into glass plates, and etching the wires away again after the completion of the other operations required, such as grinding and polishing. In this way an accurate hole is obtained. This process is complicated, and furthermore platinum has been found to be the only metal that can be used therein. A method is hereinafter described which obviates these disadvantages.

Upon the bottom of a framework which is provided with devices for winding wires to and fro and stretching them, in such a way that the wires lie parallel to one another at uniform distances apart, a sheet of glass is laid. Above this sheet of glass a wire is wound to and fro in uniform parallel turns. Upon this layer of wire a fresh sheet of glass is laid. This again is followed by a layer of wires, and this is continued until the superposed sheets of glass, with the layers of wire interposed between them, attain a substantially square cross section. The sheets of glass preferably lie between lateral struts in a more or less trough-like holder. Between the sheets of glass and the internal surfaces of the holder is provided an insulating layer, of thin asbestos paper for instance, in order to prevent the glass from subsequently uniting with the holder or with the side walls of the trough. Upon the uppermost sheet of glass is placed a cover in the form of an iron filling the trough, with an insulating layer of asbestos paper between the outer cover and the glass. The block formed of the glass plates with the interposed wires is then heated in the trough with a gas flame, while at the same time pressure is exerted upon the outer cover that closes the trough. The pressure depends upon the kind of glass employed and upon the thickness of the sheets. In many cases the intrinsic weight of the glass itself may be sufficient without extraneous pressure. Under the influence of the heat the glass passes into a viscous condition, so that the plates unite, until by diffusion in consequence of the pressure and of the correspondingly high temperature, a homogeneous block of glass is obtained. In many cases it will be more advantageous to weld the block from the individual layers one after another, so that in the first instance two layers are united to one another, then a third layer is united to the first two, and so forth, until a completely homogeneous block is obtained.

After the block of glass in the trough has been allowed to cool down to some extent by way of precaution it is taken out, placed in an annealing lehr, made free from stress, and then cut into sheets. In this way sheets of glass are obtained with a number of wires embedded therein parallel to one another and accurately spaced. If the wires are now etched out by the action of an acid, sheets of glass of any desired thickness are obtained with accurately calibrated holes.

In order to enable any desired metal wires to be employed instead of being restricted to platinum, it is sufficient to allow the heating and diffusing operation to take place in a vacuum or in an atmosphere of hydrogen, or else in an atmosphere of inert or neutral gas, as a result of which any oxidation of the wire is precluded. Wires of a base metal can then be used without risk.

In the case of boro-silicate glass there is the advantage that repeated fusing of the glass block can be effected without bubbles forming therein. Sheets of such glass can thus be directly inserted as nozzle plates in nozzle bodies, without difficulties arising, when the insertion margin is heated, by the formation of bubbles.

This method is applicable not only to glass plates but also to metal plates which are softer than the wire to be arranged between them. The metal plates are pressed together under a high pressure, this pressure preferably being applied not only in one direction, that is, vertically, but also at right angles thereto in a horizontal direction. During the pressing, however, no heating generally takes place at first, the process thus being distinct from that employed in the case of glass plates. After the pressing the plates are taken apart in an orderly manner and the wires, with the exception of one or two for each layer, which serve for fixing the position of the metal plates, are taken out. The metal plates are then superposed again in the same order, their positions being fixed by the one or two wires that have been left in the plates in each layer. The block of metal plates is now exposed to a high pressure again, and at the same time is highly heated in an atmosphere of hydrogen or inert gas or in a vacuum. The degree of heat must be such that the diffusion that now sets in proceeds with appreciable velocity, and is therefore completed under ordinary conditions in about half an hour. The metal plates are thereby united to form a completely homogeneous block of metal.

which can now be taken out of the furnace, in which the heating has taken place.

To enable the block to be cut up into sheets in the same manner as the block of glass without the fine perforations becoming choked, the latter are preferably filled, before drying, with a salt or the like of low melting point. The block is then sawn into sheets with a diamond saw, so that sheets of a thickness of from 0.3 to 3 millimetres, or even of other thicknesses if required, are obtained.

Instead of impressing the ducts by inserting wires of harder metal, they may be produced by passing the metal plates between profile rolls.

In order to obtain a block which is homogeneous in every respect, it is necessary for the materials of the plates and of the wires to be correctly related to one another. For instance if it is desired to obtain thin sheets of tantalum, difficulties are liable to arise because the metal has a high diffusion temperature. By coating the tantalum plates in advance, however, by electrolytic means for example, with a thin layer of nickel of a thickness of 0.001 of a millimetre, the diffusion during the pressing operation, even at a low temperature, is sufficiently accelerated, so that the inconvenient property of the tantalum, is thereby obviated. Other metals may also be employed for this purpose, for instance iron or niobium, or in any case a metal that combines easily with tantalum. Obviously the wires inserted must then also be of a metal having a high diffusion temperature, such as tungsten or molybdenum wire for example. Instead of tantalum, niobium may be employed.

Alternatively the method may be modified by using plates of metal that are chemically very stable, such as tantalum, niobium, gold, platinum or the like, and selecting wires of base metal, which may then be left in between the metal plates during the pressing, and only etched away after the block has been finished, as in the case of a glass block.

Tantalum and niobium may alternatively be replaced by cheaper metals, such as nickel, iron and the like, or by alloys, such as the steel alloy marketed under the trade-mark, V2A, vacuum fused alloys, or the like. With these metals, however, the material of the wire must be very carefully selected, in order that when the wire is subsequently being etched away the material of the plate may not be attacked. For this reason it is preferable to take the wires out before the diffusion.

When employing perforated metal sheets in spinning nozzles, it is necessary that the sheets should be chemically stable. If a nickel block has been produced, the nickel sheets are at first not chemically stable. They may however be made chemically stable by exposing the nickel sheets to an atmosphere of tantalum, niobium, tungsten, or molybdenum chloride, or some other halogenide. Compounds of boron may alternatively be employed instead. Such a chloride atmosphere is of such a high temperature that a reaction of the chloride with the nickel or other metals employed occurs, while the metal of the halogenated, the tantalum for example, is deposited upon the nickel, and, in consequence of the high temperature, diffuses into the nickel. In this manner there is formed inside the capillaries and around the apertures a uniformly thin and chemically stable coating.

Such coated nozzles also have the advantage that it is possible in a certain sense to harden them without affecting the surface colour of the metal. The hardening may be effected in the case of tantalum and niobium coatings, for example, by means of hydrogen, as a result of which a layer of tantalum hydride or a layer of niobium hydride is formed, which is exceedingly hard and chemically very stable. Boron and oxygen may also be employed. A hardening of solid tantalum nozzles for instance may of course also be effected by coating these nozzles with a suitable metallic layer or with boron or with oxygen. A similarly very hard layer is obtained by coating solid tantalum nozzles with a layer of tungsten.

The invention is diagrammatically illustrated in various examples in the accompanying drawings, in which

Figures 1 to 3 illustrate diagrammatically the production of homogeneous glass blocks;

Figures 4 to 7 illustrate the production of homogeneous metal blocks;

Figures 8 to 9 illustrate a modification of the process illustrated in Figures 4 to 7 by the employment of profile rolls;

Figures 10 and 11 illustrate diagrammatically in sectional elevation and in plan respectively a piece of apparatus by the aid of which the wires can be very simply introduced between the individual plates parallel to one another and at uniform distances apart.

In a trough **1**, shown in Figures 1 to 3, lie glass plates **2**, and between these glass plates a number of wires **3** are laid parallel to one another and at equal distances apart. In the direction of the arrows **4** in Figure 2 a pressure is exerted, by which, with simultaneous heating of the compressed plates, a homogeneous block is obtained as represented in Figure 3.

In the case of metal plates **5** (Figures 4 to 7), the plates are first superposed in the same manner as the glass plates **2**, with wires **3** between them. Then, without heating, a vertical pressure in the direction of the arrows **6** in Figure 5 is exerted, and also a horizontal pressure in the direction of the arrows **7**, whereupon the heating is only effected, after the wires have been removed, with the exception of one or two, **3′** and **3″**, in each layer, the plates then being secured in position by these remaining wires **3′** and **3″** when superposed again. By pressure in the direction of the arrows **8** in Figure 7, accompanied by heating, the metal plates are converted by diffusion into a homogeneous block.

If profile rolls **9** are employed, as illustrated in Figure 8, the annular projections **10** on these rolls impress grooves in the plates **5**, which are thus given the same form, shown in Figure 9, as the plates **5** that have been treated with wires, as illustrated in Figures 5 and 6.

A simple piece of apparatus for ensuring the accurate spacing and parallelism of the wires is obtained, as shown in Figures 10 and 11, by providing a base plate **11** with distance pins **12** and **12′**, arranged in the form of combs, and winding a wire **13** to and fro in a horizontal plane between the spacing pins **12** and **12′** and round reversing pins **14** and **14′** located behind them, a plate **15** of glass or metal being laid upon the base plate **11** before the first wire is wound. In a vertical direction the distance between the layers of wire is determined by spacing members **16** and **16′**, which are superposed like the plates **15**, and may be guided for instance by means of pins **17** and **17′**.

BERNHARD WEMPE.

PUBLISHED	B. WEMPE	Serial No.
APRIL 27, 1943.	METHOD OF PRODUCING PERFORATED GLASS	125,892
BY A. P. C.	Filed Feb. 15, 1937	

Fig. 1

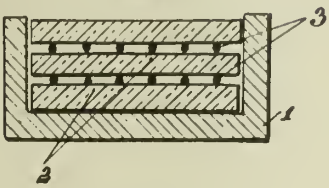


Fig. 2

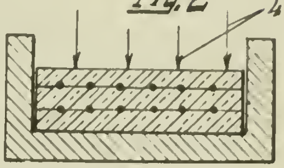


Fig. 3

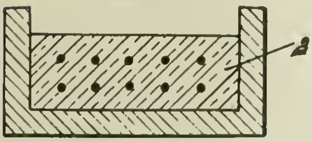


Fig. 4

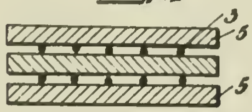


Fig. 5

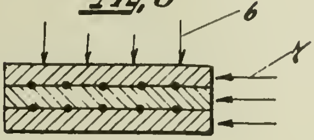


Fig. 6

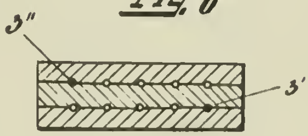


Fig. 8

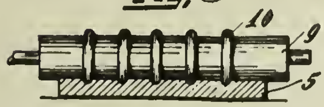


Fig. 7

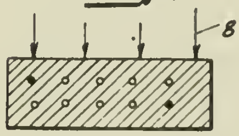


Fig. 9

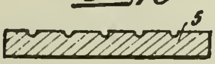


Fig. 10

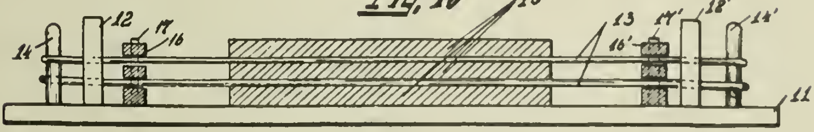
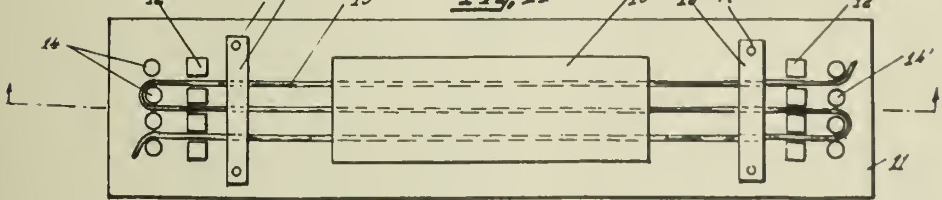


Fig. 11



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Published Apr. 27, 1943

Serial No. 140,767

ALIEN PROPERTY CUSTODIAN

PROCESS FOR REMOVING THE SUBSTANCES CONDENSED IN COLD ACCUMULATORS IN THE COOLING OF GASES

Jean Le Rouge, Boulogne-sur-Seine, France; vested in the Alien Property Custodian

No Drawing. Application filed May 4, 1937

This invention relates to a process for removing by sublimation or vaporization the substances which have been condensed in the cooling of a gas, which in the following will be called the "incoming gas," by another gas to be warmed up, which will be called the "outgoing gas," this cooling taking place through the passage of the incoming gas through a cold accumulator, that is, a container enclosing a suitable filling substance, for instance aluminium, in which the cold of the outgoing gas has been accumulated; the two gases are alternately flowing, each in a direction opposed to that of the other, through the accumulator, and in order to allow a continuous operation, a pair of accumulators is utilized.

The removal of the substances condensed in the cooling of the incoming gas in the accumulator is in principle effected by the flow therethrough of the outgoing gas, and, in order to lower the difference of temperature between the two gases and consequently facilitate this removal, for instance the sublimation of the carbon dioxide contained in the air to be separated into its components, it has already been proposed to pass through the cold accumulator, either over its entire length or over its colder part, that is, that part in which the carbon dioxide deposits, a quantity of the separated components larger than that of the incoming air to be separated.

The process according to the present invention enables the difference of temperature between the incoming and the outgoing gas to be lowered more than does the known process. Moreover it is applicable to the removal of water vapour whereas the known process is not.

The process of this invention consists in subjecting at least one of the two gases, in at least one of the two parts of its path which are situated on both sides of the place where the separation of the condensible substance begins, to a thermal action which is distinct from that to which it is submitted by the other gas through the intermediacy of the accumulator, and brings its temperature nearer to the temperature prevailing in the part of its path other than that in which the thermal action is applied.

Thus, if the thermal action is applied in that part of the accumulator in which the condensible substance to be removed is not yet depositing and which will be called in the following, for simplicity's sake, the "warmer part" of the accumulator, the thermal action will consist in a cooling; it will on the contrary consist in a heating if it is applied in that part of the accumulator in which the condensible substance deposits and which will in the following be called the "colder part" of the accumulator.

If the deposition of the condensible element to be removed only begins in the vicinity of the cold end of the accumulator, as in the case of the carbon dioxide contained in the air, it is in practice necessary to exert a cooling action; if on the contrary this element begins depositing in the vicinity of the warm end of the accumulator, as in the case of water vapour, a heating will be exerted. The cooling will be preferably exerted in the immediate vicinity of the place where the condensible element to be removed begins depositing; again the heating will be preferably exerted at the place where the condensible element no longer deposits in a troublesome amount. If moreover these cooling and heating are simultaneously exerted for the same substance to be removed, at two places of the accumulator in the localized manner above defined, the power outlay is lowered to the most.

The above mentioned thermal action may be performed in any suitable manner. Thus it may be obtained by direct contact of an agent of a suitable temperature with the gas to be heated or cooled. In the case of a heating a small quantity of the outgoing gas, formerly warmed up to the surrounding temperature and which has been brought back to its pressure at the place where the addition takes place, is added to the outgoing gas as it flows through the cold accumulator. In the case of a cooling there is added to the incoming or outgoing gas a gas colder than the same or a liquefied gas, which it will generally be useless manufacturing in a special plant because they will be found either in the accumulators or in the apparatus, such as liquefaction and rectification apparatus, to which the cold accumulators are appended. For instance in the case of the separation into its constituents of air which has not formerly been freed from its carbon dioxide, a small quantity of liquid air, which, according to the pressure of the incoming air and the degree of perfection of the accumulators, is generally comprised between ⅕% and 1% of the bulk of the treated air, is added to the incoming air, in the region of the accumulator where a temperature of about $-140°$ C. is prevailing. Again there may be added to the outgoing component a small quantity of that same component in the liquid state taken from the separating apparatus. The liquefied air or component will for instance consist of a part of the liquid formed in a liquefier by putting air under

pressure or a given amount of the component under pressure in heat exchange with the incoming air or the outgoing component taken at the cold end of the cold accumulators.

It is to be noted that this addition, to the entering or outgoing gas, of a cooling or heating agent modifies the quantity of these gases which flow through the accumulator. It may result therefrom that the difference of temperature between the two gases, while being suitable at the place of the addition, is no longer suitable in another part of the accumulator. This drawback is removed by withdrawing from that gas which has been subjected to the addition, near the place where the addition takes place, a quantity of gas which approximates that of the added agent, and which will preferably be conveyed back to a place of the plant where a temperature near that of the withdrawn gas and a pressure lower than that of this gas are prevailing; again the quantity of the gas which is not subjected to the addition may be increased over a portion of its path through the cold accumulators. In both cases substantially equal quantities of incoming and outgoing gas are flowing through all parts of the accumulators.

When the cooling agent is added to the incoming gas or the heating agent to the outgoing gas, that is, when the thermal action exerted on the gas is of the same sense as that exerted thereon on the other hand by the gas with which it is in heat exchange through the intermediacy of the accumulator, it is in particular in the region of the accumulator in which the condensed substance deposits in a troublesome amount that the addition of the cooling or heating agent tends to cause the difference of temperature between the two gases to vary along the accumulator: for equal specific heats of the incoming and outgoing gases, this difference increases as one, in this region, gets farther from the place of the addition. In order to keep this difference substantially constant in this region, one or more secondary thermic actions of the same sense as the main one may be exerted in said region. For instance a part of the cooling or heating agent may be added at one or several places disposed along this region. When the thermal action according to this invention consists in the addition, in the warmer part of the accumulator, of a cooling agent to the incoming gas, this addition is then accompanied by the addition of another portion of the cooling agent in that portion of the colder part of the accumulator which is nearest to the warmer part, the latter cooling being itself, if desired, accompanied by a heating exerted in the remaining portion of the colder part, that in which the deposition of the condensible substance is too slight to be still troublesome.

The thermal action, instead of being applied directly, may also be applied by means of an indirect contact, which will preferably be effected by means of an auxiliary fluid flowing in a closed cycle between the place where the thermal action is to be applied and a source of heat or cold. The auxiliary fluid will consist of a gas under high pressure, so as to have a great capacity under a small volume, or preferably of a fluid under such a pressure as to be alternately in the gaseous state at the higher and in the liquid state at the lower of the two temperatures between which it is circulating. When the treated gaseous mixture is air and the condensible element to be sublimated carbon dioxide, the auxiliary fluid will for instance consist of oxygen, argon or krypton circulating in a closed cycle between a heat exchanger located within one cold accumulator in the region where the temperature of about −140° C is prevailing and a second heat exchanger located either in the same or in the other cold accumulator of the pair, at a place where a lower temperature, say −160° C or −170° C, is prevailing. If then the cold end of the accumulators is placed at the top, and a U-shaped tube, with descending vertical branches, between the two heat exchangers between which the fluid circulates, the same will from itself circulate continuously according to the thermo-siphon principle, without it being necessary to utilize a circulation pump.

Another remark respecting the difference of temperature between the incoming and the outgoing gas in the different parts of the accumulators should be made. As known, for all the gases which are more compressible than taught by the law of Boyle-Mariotte, thus in particular for air and its components, the specific heat of the gas increases at the same time as the pressure, especially at low temperature so that, when both gases are in equal quantities and when the outgoing gas is under a lower pressure than the incoming one, which is generally the case, the difference of temperature between the incoming and the outgoing gas increases as the temperature falls. It results therefrom that the difference of temperature between the incoming and the outgoing gas may have been rendered small enough by the process of the invention at the place where the condensible element begins depositing and remain however too great at the cold end of this region, even when the quantities of the two gases in heat exchange are kept equal over the whole length of the accumulator in one of the above described manners. In that case a part of the cooling agent may be added in the colder part of the accumulator in the manner above described, or the process of the invention may be combined with the known process mentioned at the beginning of this specification which consists in increasing the quantity of the outgoing gas in proportion to that of the incoming one. This will for instance take place, in the case of a thermal action effected by direct contact, by taking the added agent and the withdrawn gas in quantities which are no longer equal, as assumed hereinbefore, but on the contrary unequal.

JEAN LE ROUGE.

Published Apr. 27, 1943 Serial No. 162,538

ALIEN PROPERTY CUSTODIAN

PROCESS FOR CASTING METAL INGOTS AND DEVICES THERETO

Walter Roth and Otto Reuleaux, Hannover, Germany; vested in the Alien Property Custodian

Application filed September 4, 1937

A process for casting metal ingots and devices thereto.

The invention relates to a process of making metal ingots and comprises a device for executing this process. In particular this invention refers to the production of ingot castings which are free from pipings, enclosures and segregations.

The invention further comprises a process of casting in which a particularly high rate of cooling in the vertical direction is achieved.

It further comprises the production of hollow ingots likewise free from pipings, enclosures and segregations.

An further object of the invention comprises the production of plated ingots in which the core-material is poured in a liquid state inside the plating material, which is laid along the walls of the mould, without incurring the danger of its melting.

Further objects of the invention as well as the attained advantages will become apparent from the following descriptions.

In the attached drawing the apparatus, by means of which the process is carried out, is shown diagrammatically. Figs. 1 and 2 show a vertical section through a casting device for the execution of this process. Figs. 3 and 4 show vertical sections through the device used for producing hollow ingots, while Figs. 5 and 6 show vertical sections through the device for producing the plated material. Fig. 7 is a cross section through the device shown in Fig. 5. In Fig. 1, **1** is the wall of the mould, **2** is the cast ingot which can be lowered slowly by means of the bottom **4** of the mould which is attached to the plunger **3**. This is moved by an hydraulic device **5**, not described in detail, which may be constructed ad libitum. **6** is the feeder through which the molten material passes into the mould. A cooling liquid **8** passes through the pipes **7** and from there partly through the walls of the mould and partly against the solidifying ingot.

In Fig. 2, **9** is a double-walled water-cooled mould through which the cooling liquid **8** flows. **2** is again the ingot, which is however divided into two parts by a dotted line **10** of which the top, hatched the other way, is the still liquid part, while the bottom part has already solidified. The plunger and the ingot are surrounded by a container **11** which also contains the cooling liquid **8**. The packings **12** allow the plunger to move through the box without letting the water flow out.

In Fig. 3, **9** is again the watercooled mould, **3** the plunger which moves the bottom **4** of the mould. The hollow ingot **13** is cast as before, by means of the feeder **6**. **14** is a false bottom onto which the material is cast at first. Through a not shown opening the cooling water can enter this false bottom and flow into the hollow part **15**. **16** is a hollow cylinder which is cooled with cooling water supplied through the pipe **17** and the jets **18**.

In Fig. 4 the inner cooled mandrel has a special construction. Here the cooling water is fed in by the pipe **19** and is led out by the pipe **20**. The mould **9** has holes **21** at the bottom through which the cooling water trickles down the ingot.

In Fig. 5, **22** is the cooled mould, which however in contrast with the other cylindrical ingots, shown in the other illustrations, is oval in cross-section. **6** is again a feeder, while **23** is the plating material laid against the walls of the mould. The line **24** again shows the boundary between the solidified part **25** of the ingot and the still liquid part **26**. Fig. 6 is a section along the line A—A in Fig. 5 and shows the casting device in a vertical section of the narrow side.

The process according to the invention is carried out as follows: First the bottom **4**, on the top of which the false bottom **14** may be placed, is raised to the bottom rim of the comparatively short mould by means of the plunger **3**. The height of the mould should by preference be smaller than the diameter of the ingot at the narrowest part. As soon as the bottom has reached the lower rim of the mould, liquid metal is poured incontinuously through the feeder **6** until it fills the mould almost to the brim. At the same time the cooling of the walls of the mould is started. To make this as great as possible it is important that the walls of the mould are not too thick and are made of a metal of good heat conductivity e. g. copper or aluminium. The cooling of the mould which may be achieved either by spraying or by letting the cooling water flow through a double wall, makes the ingot solidify superficially at least along the edges. As soon as the mould is almost filled, the bottom is let down gradually in such a way, that the level of the liquid in the mould remains constant. The invention requires that the casting is done so fast, and the mould is so short, that the ingot which leaves the mould at the bottom, is not yet solidified at the centre, and that the complete solidification is brought about by the cooling water which acts immediately on the superficially solidified ingot. Thus it is achieved that the solidification of the centre part of the ingot takes place mainly in an upward direction, keeping up with

the solidification of the surface. In contrast to the moulds used so far, there is no partition-wall between the cooling water and the ingot as it leaves the mould so that the cooling achieved is far greater than hitherto. The ingot thus gets a fine grain, and segregations and pipings are far better eliminated than with the previous methods.

The shortness of the mould has the further unexpected advantage that the ingot sinks by its own weight. This is further enhanced by the severe cooling of the walls of the mould from below which brings about a certain contraction of the solidified outer zones, so that the ingot is loosened from the walls of the mould. This loosening is particularly advantageous with the casting of aluminum and aluminum alloys, because these metals contract in a very great degree. If other metals with a smaller contraction coefficient are to be cast, it is advisable, to give the mould a slightly conical shape with a taper of up to 1% according to the total diameter of the ingot and the kind of metal to be cast. It is further advisable to paint for instance the walls of the mould with graphite to facilitate the sliding of the ingot.

In contrast to all other processes this invention requires no device for drawing down the ingot, either by fitting the bottom with a special device for pouring in the metal, or by using rollers to pull down the ingot. As soon as the plunger has reached its lowest point the casting is stopped and the ingot taken out.

If hollow ingots are to be cast a short hollow cooled mandrel is fixed in the centre of the mould which serves to keep open a hole in the centre of the ingot. Otherwise everything is done as described before. This hollow cooling mandrel has a strong taper, so that it is impossible for the ingot to shrink onto it. Here again the combination of the short mould with the severe cooling from below makes it possible to use such a hollow mandrel without running the risk of getting cracks.

It has proved particularly advantageous to plate ingots by means of a casting process as described above. This is carried out as follows: The false bottom **14** and the plates **23** are set on the casting table when the casting begins. The plates are welded together by the hot metal which however remains liquid for only a short time; the severe cooling from below cools them down so quickly that it is impossible for them to melt through.

Example

As an example it may be stated that on casting aluminum alloys containing about 3,5–4,5% copper and small quantities of magnesium and manganese, very good ingots are obtained, if the diameter of the ingots is about 250–300 mm and the height of the mould 160–200 mm. The metal was let in with the usual casting temperature, as far as about 4–5 cm from the top rim of the mould and then the bottom lowered with a speed of 50–90 cm/min. It was found that in this case the liquid metal in the centre of the ingot had a depth of about 150–200 mm so that the block was still liquid in the centre on leaving the mould while its immersed walls were completely solidified by the cooling water in contact with them. The cooling water itself circulated continually and was about handwarm. The outside surface of the cast ingot was so smooth and free of segregations that cuttings from it could be put straight into the recipients of the strap presses for pressing.

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PUBLISHED

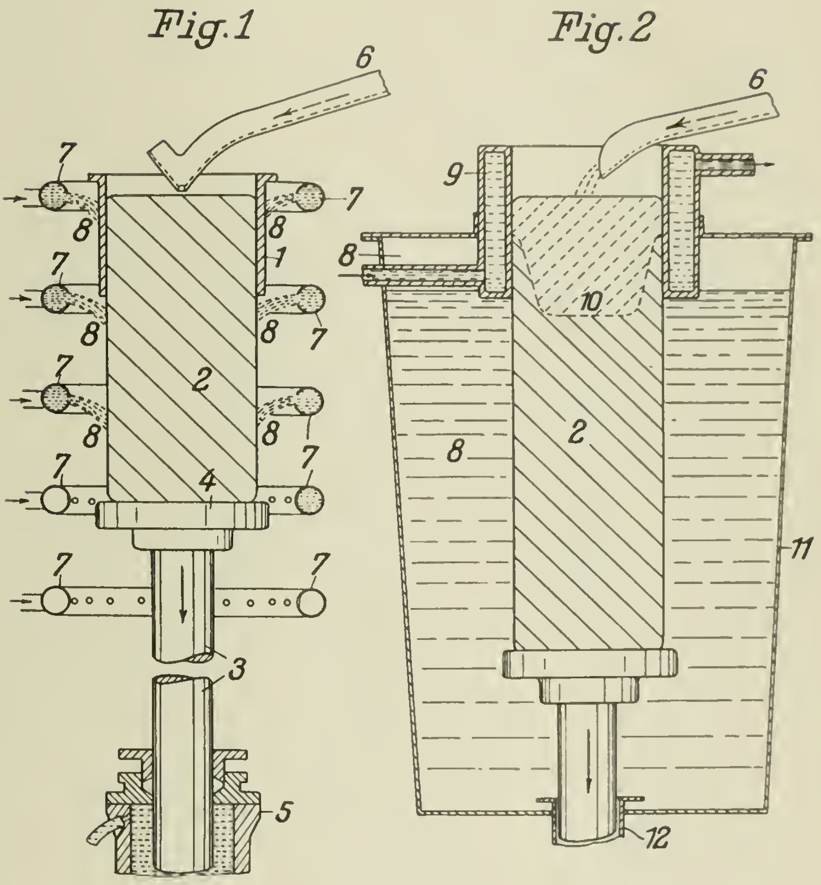
APRIL 27, 1943.

BY A. P. C.

W. ROTH ET AL
PROCESS FOR CASTING METAL INGOTS
AND DEVICES THERETO
Filed Sept. 4, 1937

Serial No.
162,538

3 Sheets-Sheet 1



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PUBLISHED
APRIL 27, 1943.
BY A. P. C.

W. ROTH ET AL
PROCESS FOR CASTING METAL INGOTS
AND DEVICES THERETO
Filed Sept. 4, 1937

Serial No.
162,538
3 Sheets-Sheet 2

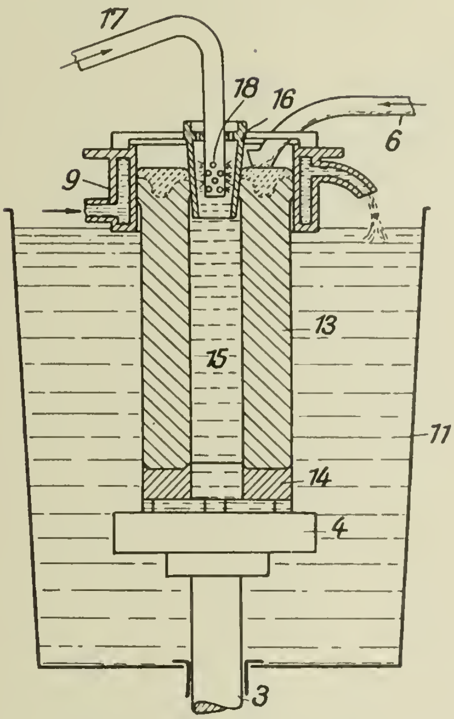

Fig. 3

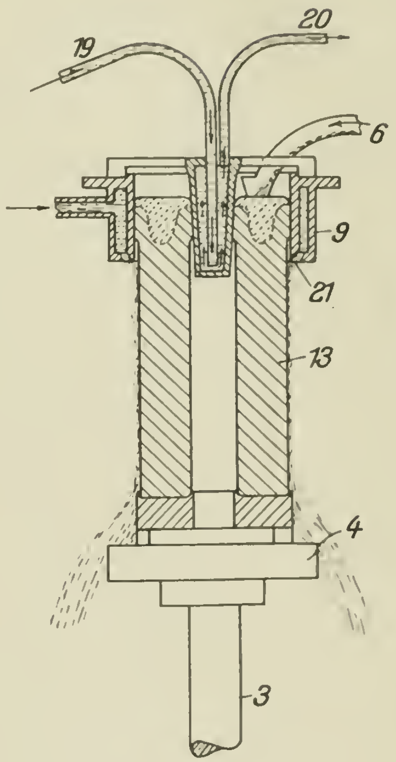

Fig. 4

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PUBLISHED
APRIL 27, 1943.
BY A. P. C.

W. ROTH ET AL
PROCESS FOR CASTING METAL INGOTS
AND DEVICES THERETO
Filed Sept. 4, 1937

Serial No.
162,538
3 Sheets-Sheet 3

Fig.5

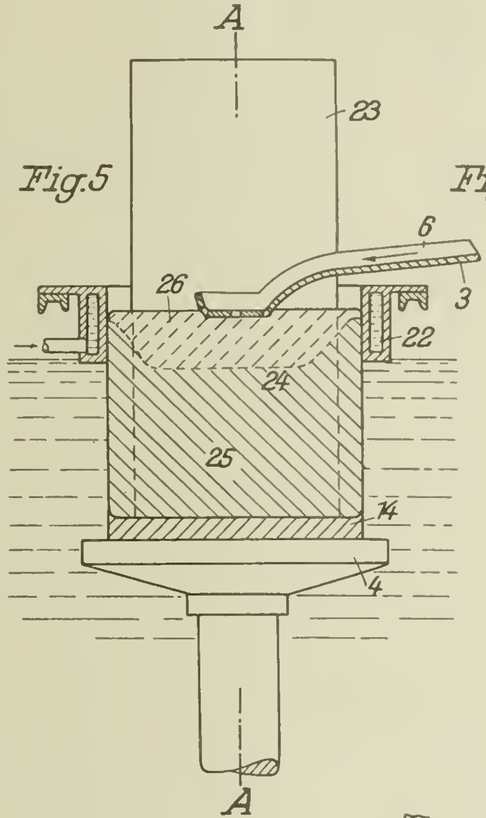


Fig.6

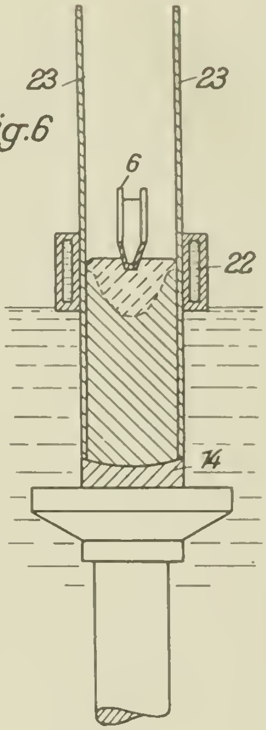
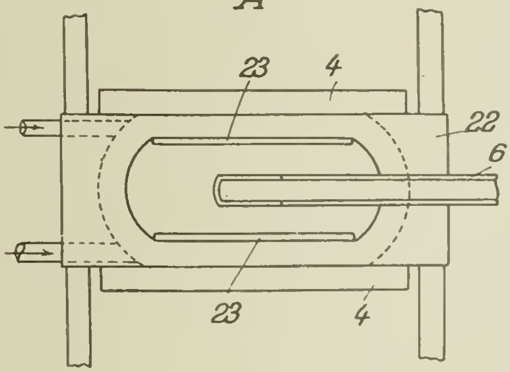


Fig.7



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Published Apr. 27, 1943

Serial No. 165,198

ALIEN PROPERTY CUSTODIAN

GAS TURBINES

Karl Leist, Berlin, Germany; vested in the Alien Property Custodian

Application filed September 22, 1937

The invention relates to a gas turbine with partial admission, more particularly axial admission, the turbine being operated by combustion gas or exhaust gas. According to the invention the gas turbine is so constructed that the rotor blades to which driving gas is not admitted are exposed and the surrounding air passes between them for cooling. In other words that section of the rotor blades to which driving gas is not admitted is not separated from the surrounding atmosphere by a closed housing, with the result that there is a considerable cooling, particularly of the inlet edges of the blades, both by thermal conduction as well as by thermal radiation.

In many cases, for example if the conditions under which the machine is incorporated make it appear desirable, an inlet chamber to which the outer air flows through a pipe may be arranged in front of the blades to which air is admitted or in front of the guide blades arranged in front of said rotor blades. To avoid an unbalanced heating and distortion, a number of sectors to which air and gas is admitted or a number of inlet chambers traversed by cooling air and driving gas, which chambers may perhaps not be directly connected together, may be so arranged that cold sectors and warm sectors are each arranged opposite one another in pairs.

In many cases the movement of the air occasioned by the rotating rotor blades will be sufficient for cooling the rotor blades. If the effect of this movement of the air should not be sufficient, it is possible to occasion or augment the air current for cooling the blades in a simple way with small power consumption.

Particularly favourable conditions are obtained when utilising the invention in the propulsion of vehicles. The power required for driving vehicles is usually small in comparison with that needed in power stations and other stationary installations. This makes it possible to have a small heat drop which can be handled in one pressure stage with one or more speed stages and with small quantities of gas, i.e. with a small degree of admission. According to the invention, with 30% admission for example, 70% of the rotor blades are constantly traversed and cooled by the considerable relative wind or by the air stream behind the existing propeller or the propeller incorporated specially for this purpose. This cooling is incidental to the drive either indirectly due to the forward movement of the vehicle or directly due to the driving propeller and it only increases the total power required to a small extent. In the case of an exhaust gas turbine this small increase in the power consumption has moreover to be met not by the turbine but by the motor.

If the cooling air flows in the manner described through a pipe, then the outer end of this pipe may be bent in the direction of travel, i.e. in the opposite direction to the relative wind, in order to increase the pressure in this pipe.

The invention is particularly suitable for turbines with axial admission as here the air current can flow directly through the spaces between blades without deflection. In addition there is the fact that, assuming equal loads, turbines with axial admission can be designed for higher peripheral speeds than turbines with radial admission, so that the former permit a partial admission even with larger output with correspondingly larger heat drop and blade length.

The heat exchange between gas and blade and between blade and air becomes so favourable on the basis of the invention that it is possible to have high final temperatures of the expanded gas without damage to the inlet edge of the rotor blades, which is particularly liable to damage, or without reducing the solidity thereof to an unallowable extent.

In order to improve the cooling, the air current flowing between the blades of the rotor can be occasioned or augmented by a suction towards the outlet end of the turbine. In the case of an open housing, even without the above-mentioned flow due to the relative wind, such a suction can occasion a cooling admission of the outer atmosphere and can be produced in various ways by means of the energy still contained in the exhaust gas when it emerges from the turbine wheel. It can for example readily be occasioned by a ring of blower blades arranged beyond the guide blades. Such a ring of blades may for example be mounted on the hub of the wheel or on the turbine shaft by means of rolling or sliding bearings, more particularly with an overhung wheel arrangement. Over the arc to which gas is admitted, the blower blades may for example be driven by the exhaust gas and the remaining arc can be utilised for producing the cooling current. If the blower is driven in the opposite direction to the turbine wheel, then the centrifugal moment of the turbine shaft is correspondingly reduced. The current of cooling air at the arcuate section where gas is not admitted is drawn by the blower against the turbine blades or through the blade passages, a funnel shaped inflow housing or a pipe as described above being provided if desired. If the peripheral speed of the blower blades is in the opposite direction to that of the turbine wheel, then its blades have an elongated section which, while affording simplicity in manufacture, corresponds approximately to that blade form which is necessary for producing the suction action at the arcuate section to which gas is not admitted.

The blades can be produced in a simple way by making radial incisions in a wheel in such

manner that the blade plates left standing between the incisions assume the desired angular position after suitable twisting. If it appears advisable to alter the outlet angle relatively to the inlet angle, then this can readily be done by bending the blades about a radial axis.

In order to obtain a favourable utilisation of the energy of emergence of the gas, guide blades may be provided between turbine and blower blades, in which case for example the guide devices arranged in the arcuate section where gas is admitted may be so constructed that they impart to the gas as large a peripheral component as possible, whereas the guide devices through which air flows may for example reduce the peripheral component to deflect or retard the air current.

At the outside it is advisable to dispose a common stationary cover ring about the turbine and blower blades with the smallest possible radial clearance. In some circumstances guide devices (e. g. guide wheel, guide ring or spiral housing) may be provided at the front of the turbine wheel in such a manner that the cooling current encounters the blades in that direction which is most suitable for good cooling and small losses.

If the guide blades direct the cooling current as far as possible into the direction of rotation of the turbine wheel then the losses become least. It is particularly favourable (above all in the case of exhaust gas turbines) that with high speed of inflow of the cooling air and particularly at small peripheral speeds of the wheel the admission of cooling air not only can produce no losses but can even result in an increase in the output of the turbine. If on the other hand the cooling current is directed against the direction of rotation, then due to the augmented impact there is an increased transfer of heat whereby the cooling action is augmented. More particularly when employed in aircraft and vehicle construction the guide devices may be adjustably arranged in known manner in order to be able to alter the angle of incidence in accordance with different peripheral speeds.

The air which otherwise has to be accelerated by the blades can be set in movement by the inflow and the suction so that in many cases the losses are considerably reduced.

If on the outlet side, stationary guide devices (e. g. guide wheel, guide ring or spiral housing) are arranged at an acute angle to the direction of rotation in place of the blower blades (or in addition thereto behind them as described above, or in front thereof), then in this way the air can be deflected and retarded and thus by a diffuser action a reduction in pressure, i. e. a suction action, can be exercised in front thereof. With increasing magnitude, the suction action can reduce the air resistance of the parts to which the air stream is admitted and finally can assist in the forward drive.

Finally the turbine blades themselves can be so constructed that they exercise a blower action over that arcuate portion to which gas is not admitted.

By suitable construction of the profile of the rotor blades it is possible for example to ensure that the resistance to the flow of air through the blades is reduced to a minimum even if it is not possible to obtain a conveyance of air after the manner of an axial blower due to the fan action. As shown in Fig. 10 and due to the small absolute speed of inflow of the air, the air current encounters the back of the turbine blades at a more or less flat angle varying with the peripheral speed. With a normal substantially symmetrical profile of the turbine blades of a constant pressure turbine there is an abrupt break in the flow beyond the inlet edge as indicated in Fig. 10. By a non-symmetrical construction, i. e. by arranging the chord joining the ends of the profile at an acute angle, it is possible—more particularly if the inlet edge is also rounded off—to obtain a flow free from losses with smaller deflection and smaller interruption in flow beyond the inlet edge as shown in Fig. 11. It is also desirable to round off the inlet edge of the blade because with increasing radius it is better possible to avoid local overheating and fracture. Preferably the radius of the inlet edge is made larger than 0.3 mm. Also, increasing the radii of curvature of the lines of flow in the blade channel has a similar favourable action.

According to the invention, therefore, with air cooling of the blades, it is proposed to employ large radii of rounding off for the inlet edge of the blades amounting for example to more than 0.3 mm. and to make the angle α (Fig. 11) between the chord joining the ends of the profile and the plane of the wheel smaller than 90°.

A further reduction of the losses for the incident flow against the backs of the blades and an increase in the blower action can be obtained by increasing the spacing of the vanes. The danger of an inadequate deflection of the lines of flow at the arcuate portion to which gas is admitted, i. e. a reduction of the peripheral component at the outlet due to excessive spacing with resultant absence of adequate guidance of the flow, can be counteracted by making the outlet angle of the blades corresponding to an efflux angle smaller than corresponds to the desired direction of outlet.

In accordance as to whether it is more important to have a small fuel consumption (e.g. aircraft with large range) or to have a small weight of machine per H.P. (aircraft for sport and for fighting purposes) the exhaust gases together with the kinetic energy still available therein can be directed through a preheater for the combustion air or can be allowed to escape directly into the atmosphere. The high temperatures and speeds of flow of the exhaust gases are very favourable for the transfer of heat in the preheater and reduce its weight.

The above described principle of cooling can be utilised for fresh gas turbines as well as for exhaust gas turbines. The proposed method of cooling can also be employed for steam turbines employing considerable superheating.

Certain embodiments of the invention are shown by way of example in the accompanying drawings, in which Fig. 1 is a side elevation in partial section of a fresh gas turbine for driving the propeller of an aeroplane.

Fig. 2 shows on a smaller scale a front view of the arrangement of Fig. 1 showing more particularly the relative positions of the housing and of the gas turbine rotor as well as by way of example the section of the rotor to which the gas is admitted.

Fig. 3 shows another embodiment in which the compressor lies in front of the turbine, which for example, can be regarded as an exhaust gas turbine.

Fig. 4 is a corresponding end view. The cooling air is introduced through two pipes, the outermost ends of which are bent into the direction of travel.

Figs. 5, 6 and 7, show diagrammatically three views of a further arrangement in which a particularly good cooling is obtained by arranging the turbine rotor at the front of the vehicle, e.g. body or wings of an aeroplane). Here the entire rotor, apart from that part to which gas is admitted, is exposed to the relative wind which has a cooling action. The gas flows from two conduits or burner chambers to the gas nozzles which are arranged opposite one another in two sectors. In Fig. 5 a boundary in the form of a Townend ring is provided in addition to the rotor blades. The guide blades are in addition shown behind the ring. The direction of travel is indicated by the arrow *a*.

Fig. 8 shows the arrangement of various guide devices, namely guide blades arranged in front of the ring of turbine blades, some (shown in full lines) directing the current of cooling air in the opposite direction to the direction of rotation and others (in dotted lines) directing the cooling air into the direction of rotation. Indicated in dotted lines between turbine and blower blades are guide blades which can be arranged on the inlet side so as to increase the tangential component, and shown in full lines are guide blades which are adapted to reduce the flow of the cooling air before reaching the blower blades. Guide blades provided in place of the blower blades or arranged behind them would have a similar appearance. In each case the arrows indicate the direction of movement of the turbine and blower blades.

Fig. 9 is a view in the radial direction of the development of the blower blades showing the acute angle β at which the disc is cut and the larger angle γ obtained by twisting the guide plates left between the cut portions. The shaded surfaces F thus indicate the lateral walls of the channels formed between the blades.

Fig. 10 shows a normal substantially symmetrical constant pressure steam turbine profile in which the air flows in the manner shown in the triangle of velocities towards the back of the blades and breaks off beyond the inlet edge.

Fig. 11 is a corresponding view of blades in accordance with the invention without sharp inlet edges and with a somewhat inclined chord joining the ends of the profile (see angle α), so that with air incident in the same direction the blades are traversed without discontinuity in the movement of the air.

Fig. 12 shows a blade diagram and triangle of velocities for the admission of gas to both rotor rings, from which it is seen that the profile of the blades of the second ring is elongated if the peripheral speed thereof is in the opposite direction to that of the turbine rotor.

In Figs. 1–7, the jet of gas flows from the burner chamber **7** through the nozzles or the nozzle chambers **8**, **8***a* and **8***b* to the blades **22** of the partial admission gas turbine, the rotor of which is indicated at **1**. The useful work of the turbine is transmitted to the propeller **3** by way of a gear train **2**. Arranged on the outlet side of the blades of the gas turbine is a ring **4** of blower blades which is mounted on the hub of the turbine rotor **1** by means of ball or roller bearings **10**. Guide plates **9** are arranged in front of and behind the blades of the gas turbine for improving the flow of cooling air.

The gas turbine also drives in known manner a compressor **5** which serves for compressing the combustion air.

The combustion air is preheated by the exhaust gas of the gas turbine in a preheater **6**.

In Fig. 1 an arrangement with small resistance to flight is shown diagrammatically adjacent the rotor blades, the cooling air being taken up by a channel in the body of the aeroplane and after passing through the blades **22** it flows away through a similar channel.

In the end view (Fig. 2) the ring of blades **22** of the gas turbine **1** is indicated by two concentric circles with radial lines extending between them. The outer periphery of the housing is indicated by B. Gas is admitted to the turbine blades over the arc C within which the turbine blades are cross-hatched, whereas the blades over the arc D do not have gas admitted to them and thus are exposed to the stream of cooling air.

In Figs. 3 and 4 the combustion gas is supplied to the blades by way of the pipes **11**, **12** and the inlet chambers 8*a*, 8*b*, whereas the outer air is directed to the blades by way of the conduits **15**, **16** and the inlet chambers **13**, **14**. The inlet chamber 8*a* is disposed symmetrically opposite to the chamber 8*b* and correspondingly the inlet chamber **13** is arranged symmetrically opposite to the inlet chamber **14** so that an unbalanced heating and distortion is avoided.

In Fig. 8, the guide blades in front of the turbine blades **18** are indicated at **17**, while the guide blades on the gas side are indicated at **19** and the guide blades on the air side between the turbine blades and the blower blades **21** are indicated at **20**. According to the invention further guide blades could be provided beyond the blower blades also.

In the diagram of Fig. 12 the upper curved profiles show the blades of the gas turbine, whereas the lower elongated profiles indicate the blades of the blower arranged at the outlet end of the turbine. In Figs. 10 and 12:

c_1 indicates the absolute speed of emergence of the gas from the nozzle,

w_1 the relative speed of entry to the turbine blades,

u the peripheral speed of the blades of the turbine rotor,

w_2 the relative speed of emergence from the rotor,

c_2 the absolute speed of emergence from the rotor,

w_3 the relative speed of entry of the gas to the blades of the blower,

u_v the peripheral speed of the blower blades,

w_4 the relative speed of emergence from the blower,

c_a the absolute speed of emergence from the blower blades.

In other respects the representation of the blades differs in no way from the customary representation.

Apart from the embodiments shown in the drawings it is possible to make a large number of modifications within the scope of the present invention. For example the axis of the turbine could be turned through 90°. It would also be possible to use multi-ring equal pressure wheels, in which case the guide devices for directing the current of cooling air could be arranged behind each rotor.

KARL LEIST.

PUBLISHED

APRIL 27, 1943.

BY A. P. C.

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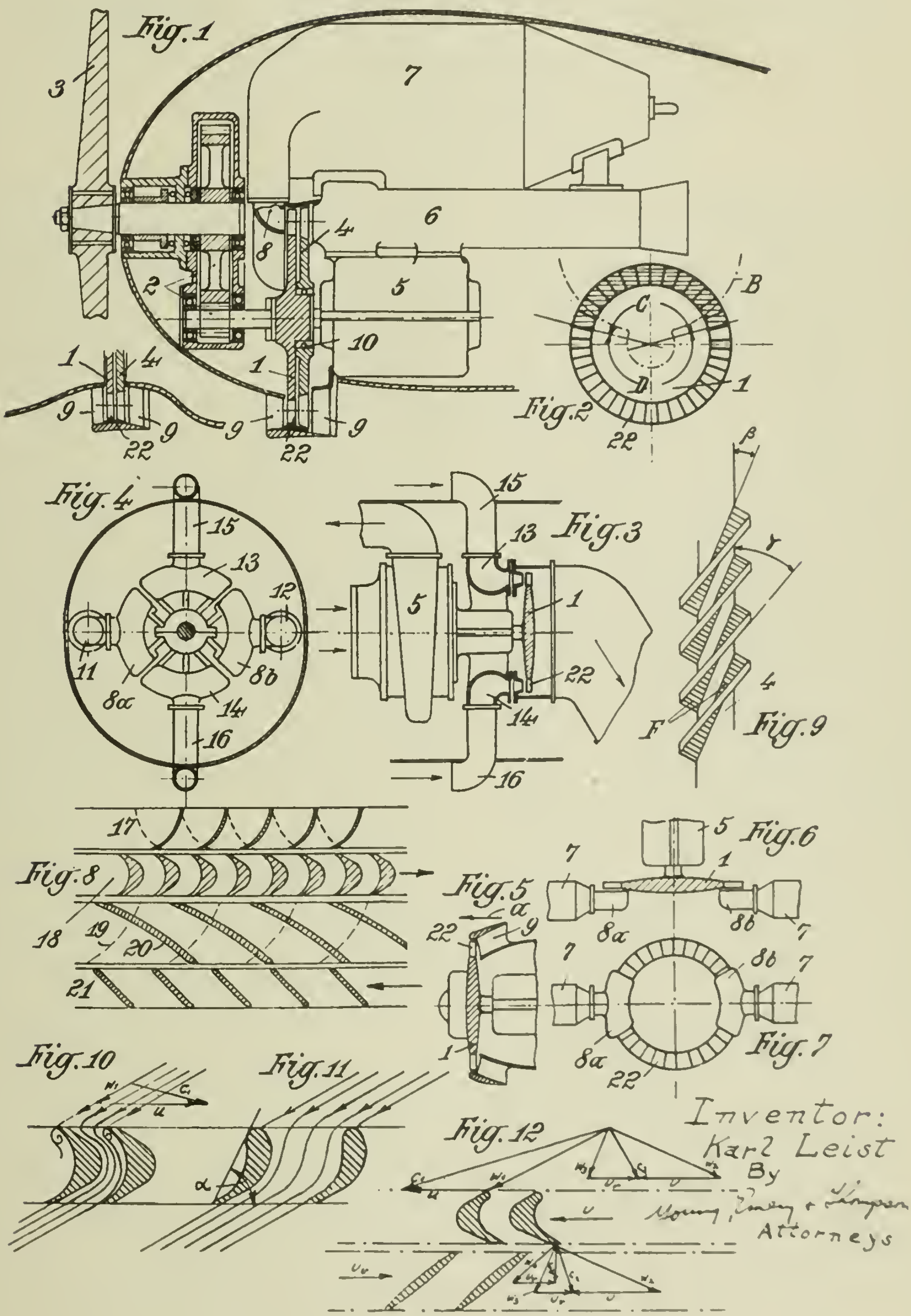
GAS TURBINES

Filed Sept. 22, 1937

Serial No.

165,198



Published Apr. 27, 1943

Serial No. 172,764

ALIEN PROPERTY CUSTODIAN

METHOD OF AND MEANS FOR TREATING TEXTILE MATERIALS

Ehrhart Franz, Leipzig, Germany; vested in the Alien Property Custodian

No Drawing. Application November 4, 1937

The object of the present invention is to the facilitate the fulling and shrinking of textile materials comprising unworked fibres as well as yarn and woven knitted goods. The invention relates particularly to the treatment of animal fibres such as wool and hair having a scaly surface, but also mixtures of such fibres, even with vegetable, artificial fibres, can be dealt with according to the invention. The shrinking of animal fibres effected by the normal fulling, i. e. the alteration in the structure of the produced material, plays an important part in the textile industry. A corresponding treatment of vegetable fibres and goods produced therefrom is not quite so important. In the case of woollen goods and mixtures of wool and other, even vegetable and artificial fibres, a close structure is required in woven as in knitted goods. The closing of the structure is obtained by the fulling which causes the fibres to nextle closer together as well as to overlap, not only in the form or parallel threads, but cross-wise, i. e. from warp to weft and vice versa. It is evident that in this manner a closing up of crevices is effected, so that in the and a material will be produced in which the woven or knitted structure is no longer recognisable.

Such a treatment, like all mechanical stressing of the materials, is naturally harmful, particularly since it must be carried out in the presence of moisture, and the damage done naturally increases with the length of the treatment. Methods of shortening the treatment have therefore frequently been proposed any satisfactory result.

By the method according to the present invention, however, such a shortening of the treatment will be obtained in a simple and at the same time satisfactory manner.

The invention consists in treating the fibres or goods obtained therefrom with lubricating substances or solutions, preferably with lubricative emulsions or suspensions. It has been found that, with equal pH value, the addition of such lubricants will speed up the fulling and shrinking process and thus shorten the time during which the mass of fibres or the goods produced therefrom, will have to be subjected to the mechanical stressing. This means, therefore, less mechanical treatment as well as a shortening of the time during which the material has to be kept in moist condition. Both of these features will contribute to the preservation of the material, a fact which can easly be proved by testing the material for elasticity and tensile strength. As lubricants suitable for carrying out the invention may be mentioned in the first-place the hydrophobic lubricant paraffin, and then others such as wax, fat, oil (even mineral oil), and mixtures thereof, i. e. chiefly well-known lubricating compounds. These lubricating media may be used either in homogenic form or in solutions. However, since the fulling is carried out in the presence of the moisture, it is best to emlpoy lubricants in the form of emulsions or suspensions. Instead of these hydrophobes or in admixture with them, hydrophilous, water-soluble compounds can be successfully employed. These compounds are capable of absorbing water and thereby acquire lubricating properties. Together with the hydrophobic compounds they constitute favourable emulsion and suspension stabilizers. In this respect they are like the hydrophiles which be mentioned later and which are subjected to strong hydration. Among the group of hydrophilous, watersoluble compounds, the aliphatic and cycloaliphatic hydroxyl compounds of fat alcohols may be mentioned as well as the amino and amide compounds. However, higher concentrated solutions of by hydrophilous, higher molecular, water-soluble compounds may by employed for the same purpose. Such colloidal solutions possess, in gel condition as well as in the subsequent solution stage, and even in the form of a froth, i. e. when emulsified with gas, excellent lubricating properties. If the last group be combined with one both of the abovementioned groups. For instance so as to use them, in a less concentrated form as dispersing media, the lubricating properties required for the treatment will be enhanced. Out of the latter group, the following may be mentioned: sodium octadecenoylmethylaminethane sulphonate, sodium butylmethylcyclohexanol sulphate, dodecanol sulphate of triethaneolamine (less alone than in combination with one or both the other groups), the condensation product of an aliphatic alcohol of higher molecular weight such as hexadecanol with ethylene oxide carried to water solubility (less than that also produces employable, hydrophilous, water-soluble or difficultly soluble compounds). It is also possible to use fat alcohol phosphate and higher amine (also oxyamine), for instance ammonium hexadecanol phosphate. Similar properties are found in the following hydrophiles: albuminous products such as gelatine, white of eggs, pectin, salts of nucleic acid, resin, alime and the like.

The lubricants are added to the fulling liquid which may either be neutral or have a pH value which approaches the isolectric range of the ma-

terials. On the other hand liquid may be alkaline or isoelectrically acid. The lubricant must naturally be adapted to the fulling liquid, since no dispersion having as dispersing medium a sebate, can be employed in an acid solution.

The invention will be further illustrated by means of the following exemples which, however, are not exclusive:

The following lubricants were prepared:

(1.) 50 parts by weight of sodium dodecanol sulphate were dissolved in 1,000 parts of water. While the solution is stirred 50 parts by weight of molten hexadecanol having a fusing point of about 40° C are added, and the mixture is diluted by the slow addition thereto of 4,000 parts of hot water, the mixture is stirred until cold.

(2.) 320 parts by weight of paraffin (fusing point 38–42° C) are melted together with 30 parts stearic acid and 10 parts triethanelamine. This mixture is poured in a thin jet and under stirring into 1,000 parts of water of about 50° C, the stirring being continued until the mixture is cold.

(3.) A soap composed of 33 parts by weight of oleic acid, 8.5 parts 40% potassium lye, and 100 parts of water of 80° C, is dissolved in 300 parts of water. This solution is stirred while 90 parts by weight of amide oleate and 60 parts molten paraffin are gradually added together with 900 parts warm water. The mixture is stirred until cold.

(4.) Example 3 is repeated, but the amide is replaced by a fat alcohol such as hexadecanol or octadecanol, a mixture of both, or a mixture of such fat alcohol with an amide.

(5.) In solution of 83.5 parts by weight of earth nut oil and 33 parts olein, 6.3 parts by weight of concentrated aqueous ammonia are added. The hot solution is mixed under stirring with 917.2 parts of water of about 40° C, and the stirring is continued until the mixture is cold.

(6.) The same as example 5, but the earth nut oil is replaced by mineral oil.

(7.) The commercial mixture of sodium hexametaphosphate and sodium tetrametaphosphate is used in a 10% aqueous solution.

(8.) A 3% solution is formed of slightly sulphurated caster oil (so-called turkey-red oil). The slight degrees of sulphuration is easily recognised by fact that large quantities of unsulphurated oil can be extracted by means of ether from a diluted solution thereof.

(9.) In a mixture of mineral oil and olein the calculated quantity of alkali lye, some turkey-red oil, and a given quantity of alcohol for clearing, are added. A clear liquid is obtained which, on dilution with water, gives a highly dispersive emulsion. Lubricants made up according to the above examples were used in the fulling of uniform piece of an easily fulled wool fabric. Each piece was treated in a testing device for one hour at a temperature of 30° C, and the percentage of shrinking in lenght and breadth in each particular case is shown in the following table:

	Per cent
Water alone	18
(1) 1% solution	41
(2) 1:3 water	51
(3) 1:5 water	53
(4) 1:3 water	59
(5) 1:3 water	44
(6) 1:3 water	32
(7) 10% solution	51.5
(8) 5% solution	46
(9) 1:5 water	48
Soap 1 gramme per litre	26
Soap 1%	42

In these results it is to be noted that the pH value of the solution plays an important part. It was found that the shrinking property of wool is less within the isoelectric range than in the case of the acid and alkali range. Particularly in the alkali range the effect aimed at by the present invention seems to be enhanced by the alkalinity, but it should be noted that the increased alkalinity invlves increased injury to the goods. The present invention is not limited to the treatment of animal materials. It has been found that the treatment is also effective in the case of material made of native as well as regenerated cellulose and derivatives thereof. For instance it can be used in the manufacture of waterproof material i. e. a material which does not shrivel up when wet.

EHRHART FRANZ.

Published Apr. 27, 1943

Serial No. 176,880

ALIEN PROPERTY CUSTODIAN

INSIDE-LINED LIGHT METAL ENGINE-CYLINDER AND METHOD OF MAKING SAME

Alfred Lesage, Schweinfurt, Germany; vested in the Alien Property Custodian

Application filed November 27, 1937

This invention relates to cylinders of engines, and more particularly internal combustion motors made of light metal, with a view of preserving the inner face thereof from wear by the application thereto of a lining of harder and stronger metal or alloy.

In order that motor cylinders made of aluminium or aluminium alloys are prevented from quickly wearing out it has repeatedly been suggested to coat the surface of contact with the piston with a layer of higher hardness. For instance, for this purpose there has been utilised the well-known metallization process for creating a layer of iron or of another metal in this way. On the surface of contact also galvanic deposits of hard metals have been produced or iron or steel liners have been pressed by means of hydraulic presses into the bore of the cylinders. In all these methods is inherent the inconvenience that the coat forming the surface of contact with the running piston is insufficiently united with the light metal cylinder proper and that the heat is thus carried off rather poorly.

The object of the invention is to do away with the said drawbacks by the lining being obtained by pouring liquid metal, preferably iron, steel or a hard aluminium alloy, into the cylinder, e. g. with the aid of a special core which can be readily removed subsequently. Preferably the liquid metal is poured through a central bore of the core centered within the cylinder, and through ducts branched from said bore and directed to the inner face of the cylinder; there the melted metal enters the annular channel between the cylinder and the core so as to fill the same as far as the top and to intimately unite itself with the inside of the light metal cylinder by fusing the adjacent face thereof, thus substantially forming an intermediate alloy of the two metals at their contacting faces, as diagrammatically illustrated in Fig. 1 by a partial sectional view of the cylinder wall and liner. This will result in a better transmission of heat to the cooling ribs of the cylinder.

The union between the different metals can even be improved in such a way that while the liquid metal is being poured the cylinder together with the core in place is subject to a rapid rotation so that by the centrifugal force the metal is under higher pressure urged into the annular channel and against the interior surface of the cylinder so as to form a coating of higher density.

Other objects and advantages will appear in the following specification while the features of the invention will be pointed out in the appended claims.

The annexed drawing by way of example shows a device for carrying out a method for the production of the liner. Fig. 2 is a sectional elevation of the cylinder and the core placed therein. This figure also shows means for centrifuging in side elevation, partially in section.

The cylinder 3 made of a light metal, such as aluminium or its alloys, is secured e. g. by means of clamps 9 to a support 2 which also closes its bottom end. A core 4, which may comprise several parts and is provided with a central bore 5 for the reception of the liquid metal, is put into the bore of the cylinder. Between the inside surface of the cylinder 3 and the peripheral surface of the core 4 there is left an annular space 6 the width of which depends on the thickness required of the cylinder liner and on the liquidity of the metal used for the latter. At the top of the cylinder, which is closed by a shoulder of the core, the bore of the cylinder is flared as at 7 in order that in this place a flange securing the liner to the cylinder is formed. From the bore 5 there are in any suitable hight branched radial channels 8 which communicate with the annular space 6. In order that the core 4 is centred more reliably the closing support 2 is e. g. provided with a depression into which the bottom end of the said core extends while at the top end this core may be engaged with the cylinder.

The same device may also be used for casting with the assistance of centrifugal force inasmuch as the support 2 carrying the cylinder is fast on a vertical shaft 10 adapted to be rotated at high speed about the axis of the cylinder 3. When this is done the liquid metal is caused to flow under higher pressure in an outward direction in the channels 8 so that it rises in the annular space 6 more quickly and is given a denser structure therein.

The use of the special device for pouring the metal results in certain advantages. The core 4 which may be fastened in any suitable way in the cylinder extends beyond the top by any length desired so that a high lost head is obtained. It is preferably made of a bad heat conductor in order to prevent the metal poured in from quickly cooling down. To this end it may be moulded of sand or a heat resisting material. In the first instance it can readily be removed by being crushed while a solid core would at least be made in two parts the joint of which is disposed about in a plane passing through the channels 8, as indicated by the broken line A—B of Fig. 2, the two parts being interconnected by dowel pins 12. Then the top portion of the core, which has a slightly ta-

pered peripheral surface, can readily be withdrawn upwardly and detached from the lower portion.

Finally the core may even be dispensed with in case the metal is poured into the cylinder being spun about its axis in vertical or horizontal position.

The welded unification of the two different metals forming the engine-cylinder will be best attained by casting with well regulated temperatures. The light metal or aluminium alloy of the outer portion of the cylinder melting at a lower temperature than the harder lining metal, such as cast-iron, steel, hard aluminium or similar alloy, is liquefied when the latter enters the space left for the lining thereby forming an intermediate alloy uniting the two metals. By cooling the cylinder the said liquefaction can be limited to a superficial zone of the cylinder wall. On the other hand, the cylinder may be pre-heated or heat otherwise conveyed when the temperature of the lining metal does not suffice to melt the cylinder wall superficially.

The compound engine-cylinder above-disclosed has the advantage that its structure is not anywhere interrupted so that continuous transmission of the heat resulting from the combustion to the cooling ribs takes place while extension by heat is almost uniform throughout.

ALFRED LESAGE.

PUBLISHED

APRIL 27, 1943.

BY A. P. C.

A. LESAGE

INSIDE-LINED LIGHT METAL ENGINE-CYLINDER

AND METHOD OF MAKING SAME

Filed Nov. 27, 1937

Serial No.

176,880

Fig. 2.

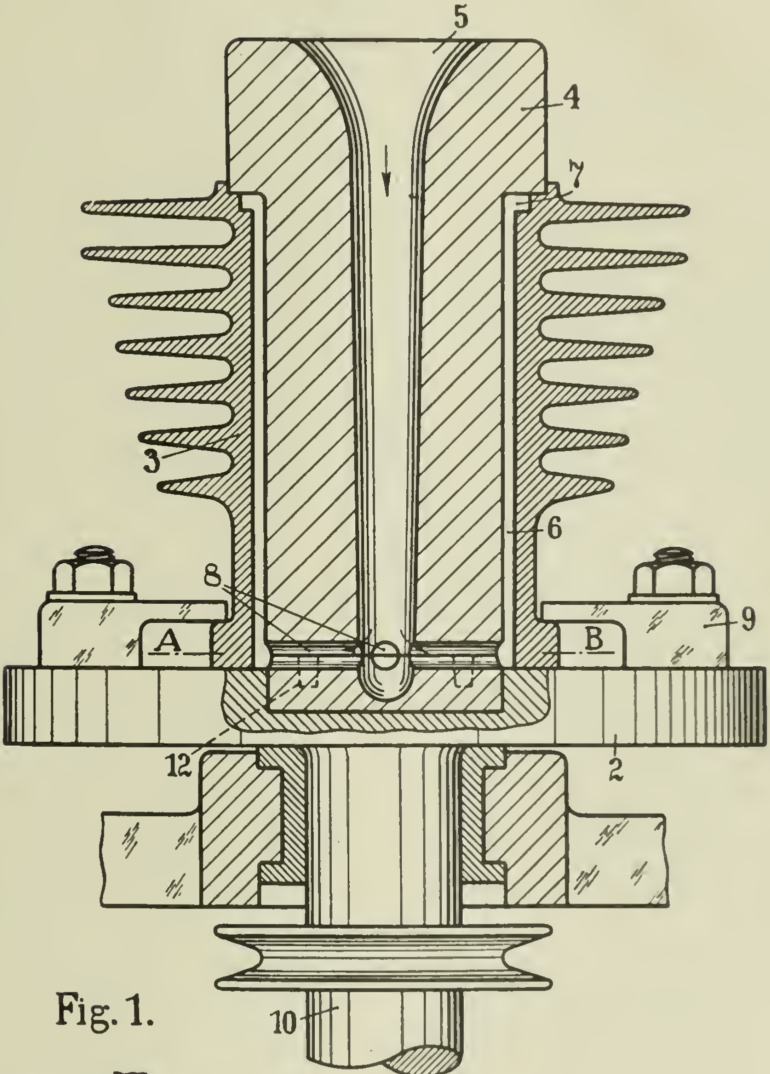
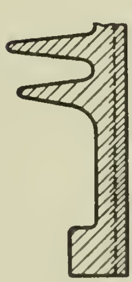


Fig. 1.



Inventor

Alfred Lesage

per

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Published Apr. 27, 1943

Serial No. 182,910

ALIEN PROPERTY CUSTODIAN

YARN AND METHOD OF MAKING SAME

Ehrhart Franz, Leipzig, Germany; vested in the Alien Property Custodian

No Drawing. Application filed December 31, 1937

This invention concerns a manufacture of yarn from staple fibre, or from such fibre in mixture with other fibre. Staple fibre, i.e. fibre cut from rayon filament by way of contrast to natural textile fibre, consists in the present art of threads cut fairly uniformly to a definite length corresponding to that of natural cotton or wool fibre. The filament is thus, e.g. after having been exuded from the spinning bath, cut and loosened, e.g. it is floated in water and upset by obstacles opposing the free flow of the pieces in the water. The loosened staple fibre is then treated on carding machines and so forth, similarly to natural fibres, and finally spun into yarn. Attempts to work the staple fibre directly, i.e. without loosening and combing, have not met with success. But it has always been considered of importance that the filament be as uniform as possible in size, and also as to the length of the staple fibre.

In accordance with the instant invention, a yarn, which is greatly improved in many respects is obtained when we do not reduce the filament to staple of uniform size and length. But the filament is cut into pieces of different lengths, the choice in the mixture of varying lengths depending upon the particular nature and prior treatments of the artificial filament. The best possible ratios as to lengths and quantities of different lengths are preferably and most readily determined in an empirical way, by systematically preparing mixtures of varying ratios and proportions, and by a comparison of the resultant yarns in respect to their mechanical characteristics.

It is also of advantage to use filament varying in fineness, e.g. to make filaments of different fineness or size; and then again to determine empirically the best possible ratio of mixing. A careful analysis of commercial rayon has been carried out in this connection and has elicited, that there are considerable variations and fluctuations as to the size of filament. But the arbitrariness with which such variations and fluctuations occur, indicates that they are caused by accidental variations in the clear opening of the nozzle through which the filament is exuded: they cannot be attributed to a predetermined and planned schedule of variations in size. On the other hand my research has also shown, that a predetermined coordination as to fineness, e.g. a planned mixing in a fixed proportion of filament assorted as to size, is extremely useful in the manufacture of coarser yarn, yarn used for rug and carpet for instance. As a matter of fact crossbredswool cannot be successfully mixed with rayon, unless there is a scheduled mixing of fibre of different size.

Particular advantages will result, when a fixed mixing schedule is observed, which can be readily ascertained by test, and in which the mixing of the fibre is rationed in respect to the size as well as concerning the length of the filament; generally speaking, it is advisable to use longer pieces of finer, and shorter pieces of heavier fibre or filament.

The maxim of using greater lengths of thinner fibre is also known in the conversion of natural fibre. It was the natural outcome of the recognition, that uniformity in length and size must be observed in order to obtain a yarn of greater strength,—aside from a careful consideration of the convolutions per unit length in twisting and doubling. Thus diagrams evaluating the length and fineness or size of the fibre have come into general use in connection with natural fibre. But it has not been known before to assort the rayon fibre in this manner, to mix assorted fibres and thus to obtain superior results. This must evidently be attributed to a lack of analogy according to which we cannot, for instance, compare the scaleless rayon with a well scaled and crimped wool; fixed rules do not apply to one as well as the other though artificial crimping of rayon fibre confers more wool-like properties upon the rayon.

Assorted fibre may be dosed in the empirically evaluated preferred ratios of mixtures in various ways. Thus the endless rayon filament is not cut in uniform length as before, but the cut is arranged so that we immediately have a mixture of varying lengths of fibre, i.e. they vary in accordance with the predeterminedly preferred ratios of length. Variations of size may of course be simultaneously obtained by predetermined differentiations in the clear opening of different nozzles.

We may modify the operation by cutting from the endless filament bundles of different length, each bundle containing staple of like length, and may then mix with each other bundles, which differ from each other in respect to length.

A predetermined assorting in respect to length as well as to size may be brought about, by providing shorter bundles of finer filament, and longer bundles of heavier filament,—the staple of each bundle being, of course, uniform in length. Then the various bundles are mixed with each other in accordance with the predetermined schedule.

In order to effect a difference in length between the various filamentary pieces of a bundle, we may cut at an angle and/or along a curved path, such cuts alternating with cuts in a normal, transverse direction, or with cuts conversely slanted or curved. If in successive cuts the cutting means is for instance oppositely slanted, these cuts may be reversed in respect to each other in mirror fashion.

It should be mentioned, that such a predeterminedly mixed material may even go immediately into the combing process, i.e. the steps of loos-

ening and carding might be dispensed with, and considerable losses which are normally entailed in these steps of procedure, are thus eliminated. The same applies to the artificially crimped material mentioned hereinabove.

The advantages obtained by use of the instant invention, and its procedure will be better understood from the following comparison, which is however to be interpreted as an illustration rather than in limitation.

The chart below lists to the left the length and size of each staple fibre used, their size being given in Denier and their length in millimeter. To the right we have lots with different mixtures of these fibres, the percentages of the various fibre, I, II or III, mixed together in each lot being tabulated under the heading of the lot. (A, B, C or D)

	Staple fibre		Fibre mixtures			
	Denier	Length	Lot A	Lot B	Lot C	Lot D
		m/m	Per cent	Per cent	Per cent	Per cent
I	2.75	100	100	75	33	66
II	3.75	120			33	
III	6.00	150		25	34	34

Yarns A, B, C and D were worked up in the ordinary worsted process. Even initially, before the spinning operation, Lots B and C proved vastly superior to Lot A, and this was more outspoken, in respect to Lot C than Lot B. In the spinning process Lot A again was greatly inferior, but in this instance Lot C was slightly better than Lot B. The material was spun at 3300 rpm, with 6.03 twist per centimeter, 52 meters of yarn per grain. The mechanical test then showed the following comparison:

	A	C	D
Less than two-thirds of the average strength per cent	10.0	4.3	7.2
Breaking length km	6.10	6.82	7.45
Breaking strength gram	112.2	132.5	144.9
Elongation per cent	6.2	6.2	7.0
Unevenness do	20.43	14.82	18.93
Breaks do	2.96	0.85	1.72
Nubs per gram combed	64	26	34

For a carpet material a mixture of yarns 25–35 diameter with yarn 3–5 diameter proved particularly suitable for spinning.

EHRHART FRANZ.

Published Apr. 27, 1943

Serial No. 185,492

ALIEN PROPERTY CUSTODIAN

CORRUGATED PLYWOOD AND APPARATUS FOR THE MANUFACTURE OF SUCH CORRUGATED WOOD

Friedrich Wilhelm Franke, Leipzig, Germany; vested in the Alien Property Custodian

Application filed January 18, 1938

This invention relates to corrugated plywood, corrugated wood, manufactured by a particular process, and to apparatus for the manufacture of such corrugated wood.

The corrugated plywood may be defined as follows: the meaning of corrugated cardboard is well known, it is cardboard which is given the shape of waves or corrugated shape and retains it, this being ensured preferably by gluing on to it a flat support or bottom layer also say of cardboard, or a bottom layer and a top layer say of flat cardboard.

It was known to give flat wood webs temporarily a corrugated shape in order to obtain a flexible veneer, but up to now it was not known how to make such wood to keep its corrugated shape. For that reason it was hitherto impossible to manufacture corrugated plywood (corrugated wood).

Experiments of the inventor have shown that this object cannot be attained by giving thin webs of wood corrugated shape in the same way as in the corrugated cardboard manufacture, and by securing the apex of the corrugations to a flat wood web by gluing. Such a material shows a highly undesirable working or warping of the corrugated wood. In spite of the fact that the waves are arranged, of course, parallel to the direction of the grain, in the course of time there takes place an equalization of the tension produced by the corrugation, certain wood portions splinter off, the texture of the corrugated wood is loosened.

These phenomena become more particularly objectionable when it is attempted to saw such corrugated wood, as owing to the said loosening, there is such a splintering that the sawing is rendered quite impossible.

This invention largely avoids these drawbacks, and makes it possible to obtain in a simple manner a corrugated wood similar to the corrugated cardboard, that is to say a light material with excellent and entirely unexpected properties.

The present invention consists in that the preferably freshly stripped thin web of wood, if desired prepared by impregnation with artificial resin components or other, is covered at both sides, that is to say top and bottom, with a thin layer of paper, Metal, fabric or foil of some other artificial material. These covering layers are glued to the wood, preferably with a glue containing silicates or with a silicate as glue. More particularly suitable for the purpose is a glue of sodium-potassium silicate mixed with glucose, carbonate of lime and a fatty oil rendered soluble in water by sulphonating (see German Patent ------)

This coated web, if desired is further treated with artificial resin components and the like, passes through a fluting roller installation, the parts of which working on the wood are heated. It is preferable to proceed by first putting on the glue in the same maschine, and by producing the corrugations before and during the setting. The flat bottom webs or the flat bottom and upper webs are then also glued in the same apparatus to the corrugated web and secured to it by passing the whole over heated surfaces.

The corrugated wood thus produced can then be converted into a "tube plate" by gluing a further flat web on the corrugated side, this tube-plate representing an excellent light plate which can be generally used wherever hitherto one used plywood which is, however, much heavier.

It is even possible to manufacture flexible corrugated wood by arranging the grain of the covering plate parallel to the grain of the corrugated wood. By bending such a place and placing at the back of its corrugated side another bent wood plate to be glued on, it is possible to manufacture bent "tube-plates", for instance barrels for fruit and the like. If on the contrary the grain of the covering plate is arranged at an angle, preferably at right angle to the grain of the corrugated plate, elastic but not bendable kinds of plywood will be obtained, which have considerable advantages over the ordinary plywood. First of all such plates are considerably lighter than the corresponding plywood plates, and besides they have a much better cold, heat and sound insulating property.

It must be pointed out that for the manufacture of corrugated wood should be used freshly stripped wood webs. This is probably the first process in which freshly stripped wood has to be used.

It must be mentioned that the corrugated web retains its shape even without having a botton plate glued-on. For instance, the apex points of the corrugated webs can be glued together, a honeycomb-like structure without rectilinear bridges thus being obtained.

Corrugated wood rigid at one side, that is to say corrugated wood in which the grain of the corrugated web is at an angle to the covering plate, is glued in a stack to a single block and sawn at right angles to the stack by means of a circular saw, plates with honeycomb structure being thereby produced. These plates or discs can be used as a central layer, that is to say ac-

cording to Figure 4, glued to a bottom plate and to a top plate. These wooden plates are called honeycomb corrugated wood-plywood plates.

For fixed dimensions (standard dimensions) round a suitably cut stack of superposed glued together corrugated wood plates, is glued a wood frame with thick walls. This stack is sawn as described at right angles to the grain of the corrugated wood, and in that way is obtained a framed corrugated wood honeycomb central layer. Such a central layer can be locked with wood, metal, cardboard, and the like.

On rigid corrugated wood being placed in wooden frames of equal height and boring holes in the branches of the wooden tubes, after veneering it at both sides, that is to say after providing it with bottom and top plate, a corrugated wood plate with through air ducts will be obtained as shown in Fig. 5. This plate is more particularly suitable for doors, wall panelling and the like.

The hollow spaces in the plates, more particularly in those with honeycomb structure, may be filled with insulating material such as cork and the like, in loose state, as well as coated with layers of gypsum (with saw-dust), concrete, tar composition, cement, and the like.

Fig. 1 shows diagrammatically an apparatus for carrying out the process for the manufacture of corrugated wood.

Fig. 2 is a section through a corrugated wood plate.

Fig. 3, a tube plate made of corrugated wood.

Fig. 4 a honeycomb plywood plate, and

Fig. 5 a door with solid frame and insertion of corrugated wood with air ducts.

In the aforementioned accompanying drawings, *a* is the wood web, *b* the paper webs, *c* gluers on, *d* fluting roller, *e* fluting roller, *f* fluting roller, *h* corrugated conveyor band, *i* covering veneer, *k* heated table for putting on the bottom plates.

The freshly stripped wood web *a* is introduced for instance with the grain direction parallel to the fluting rollers *d* and *e*, between the fluting rollers *d* and *e*. The two paper webs *b* are introduced simultaneously with the wood web *a*. Before passing through the fluting rollers, the paper webs *b* are coated with glue which is contained in the gluing-on devise *c*. The value of the glued-on paper webs is that they protect thin wood webs from bursting and shrinking. Moreover, in the finished corrugated wood, splintering of the wood during sawing is precluded. The action of humidity is also stopped by the paper webs. The sized paper webs make possible a rigid and permanent corrugated shape in order to avoid a tension at the glued point.

The two combined materials are driven by the fluting rollers *e* and *f* as well as by the corrugated conveyor band *h* and the guide wall *g*. The corrugated wood passes on its way the gluing device *c* with the fluting roller where the projections are coated with glue.

The covering or top veneer *i* is introduced when the corrugated wood reaches the vertical point of the conveyor *h*.

The corrugated conveyor band *h* guides and exerts pressure on the glued joints. All the fluting rollers, conveyors and the supporting table are heated in order to accelerate the drying of the wood and the setting of the glue. The covering wood web may comprise two wood grain directions, namely grain directions at an angle to the corrugated wood, this gives a rigid corrugated wood tube plate shown in Fig. 2. If it is desired to produce flexible corrugated wood, then the two grain directions are arranged parallel to each other. Both covering webs the grain direction veneers at an angle to the corrugated wood web, produces a light rigid and insulating plywood plate with air ducts, shown in Fig. 3. Figs. 4 and 5 were already referred to in the foregoing.

The corrugated wood and in the same way the plates to be made from it, with tubes or honeycomb structure, can never become warped, nor does there take place any distortion and sagging of the covering webs, as the glue for securing the covering plates—the veneering—is put on only on the projecting edges of the corrugated wood fluting rollers and of the corrugated honeycomb wood central layers, and not, as otherwise usual, over the whole veneering surface. Among the substantial advantages of the corrugated wood and of light plates manufactured from it, may be mentioned: light weight, good insulating properties and low cost. Of the wide variety of uses may be mentioned: building parts also for tropics, panelling, partitions, furniture making, door making, packing purposes and barrels, light buildings, exhibition stands, film green rooms and building, week-end houses. The saving in wood and, compared to the ordinary plywood, also in glue, is considerable.

It is claimed that the following advantages are achieved by the invention:

a. Corrugated wood from thin freshly stripped wood web, covered with paper, metal foil and the like, glued say with the aid of silicates or artificial resin-containing glues, corrugated parallel to the grain, with drying of the glue, if desired impregnated with artificial salt and the like.

b. Corrugated wood unit according to *à* with a glued-on flat wooden plate with grain arranged parallel or at an angle to the grain of the wood, or with a plywood plate with gluing of the contact lines.

c. Tube plates of corrugated wood according to *b*, with the corrugated open sides also covered with a flat plate, if desired a plywood plate, thc corrugations glued together at the lines of contact, if desired with a frame of solid wood glued on.

d. Honeycomb wood plate from a stack, if desired framed, of superposed glued together layers, flat plate—corrugated wood—flat plate—corrugated wood, etc. also superposed and glued together layers of corrugated wood, the stack being cut into discs and flat wood or plywood plates being glued on the cut open sides, the gluing being done at the points of contact.

e. Honeycomb wood plate as *d*, obtained out of a single stack of: flat plate—plurality of corrugated plates—flat plate.

f. Building plates according to *a* to *e* with the substitution for the flat wood plates, of plates of other material such as cardboard, artificial resin, artificial resin board, insulating material, Fig. 5 metal, etc. but with intermediate layers containing corrugated wood.

g. Building plates according to *b* to *f* with filling of the hollow spaces with insulating material such as cork and the like.

h. Apparatus for the manufacture of corrugated wood with covering, if desired with simultaneous gluing-on of a flat web, as diagrammatically illustrated and described.

FRIEDRICH WILHELM FRANKE.

PUBLISHED

APRIL 27, 1943.

BY A. P. C.

F. W. FRANKE

MATERIALS COMPRISING CORRUGATED WOOD

Filed Jan. 18, 1938

Serial No.
185,492

Fig. 1.

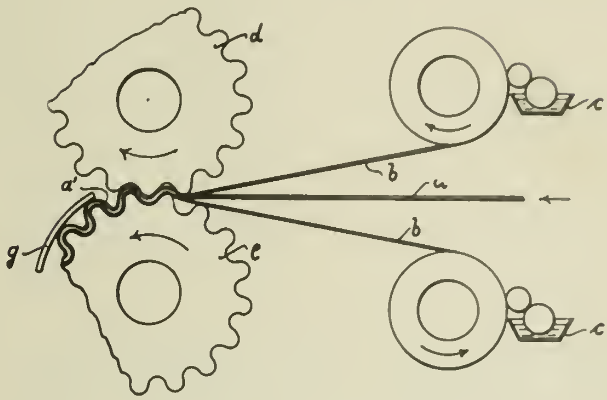


Fig. 2.

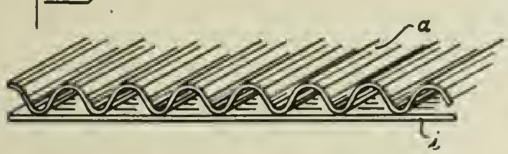


Fig. 3.

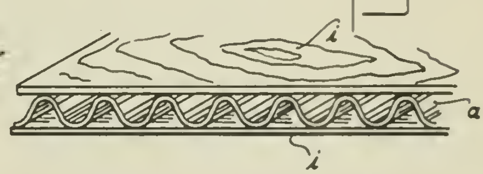


Fig. 4.

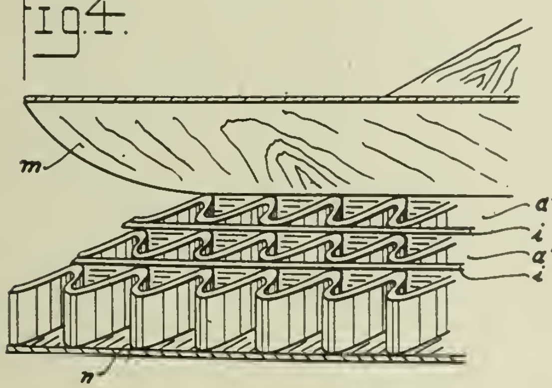


Fig. 5.

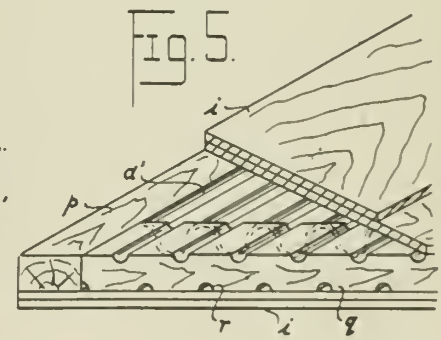
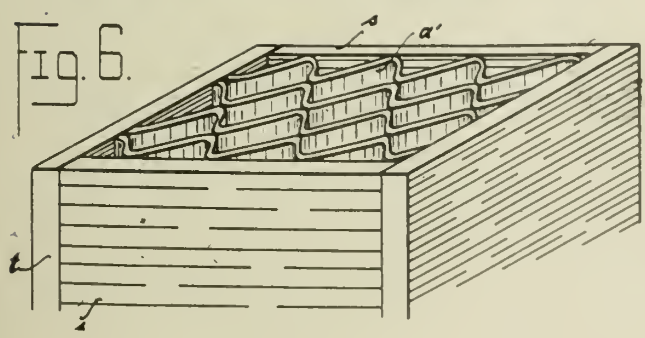


Fig. 6.



Friedrich Wilhelm Franke.
INVENTOR

BY
ATTORNEY

Published Apr. 27, 1943

Serial No. 190,794

ALIEN PROPERTY CUSTODIAN

SUCTION BRUSH FOR VACUUM CLEANERS

Wilhelm Weimers, Berlin-Reinickendorf, Germany; vested in the Alien Property Custodian

Application filed February 16, 1938

The present invention relates to vacuum cleaning devices, and more particularly to a suction brush therefor. According to the invention all parts of the brush, such as the housing, suction mouthpiece and connection member for the suction tube are made of an elastic material, such as, for instance, rubber. In this case the suction brush is preferably so designed that a ring consisting of the same elastic material and surrounding the greater portion of the brush bristles in the form of a protective sleeve is integral with the other parts of the brush.

By designing the suction brush in such a manner the great advantage is obtained that the suction brush may be easily adapted to the surfaces to be treated, that objects calling for a careful treatment cannot be damaged by the same and that the brush even in the case of ill-usage has a long life. Besides, the brush presents the further advantage in that the bristles may easily be secured to the housing of the brush in a reliable manner. Furthermore, the manufacture thereof is very simple and economical, since it may be made as a whole of the same material.

In the accompanying drawing is shown an embodiment of the invention in which the single figure shows a view, partly in section of the brush according to the invention. **1** is a disk-shaped body forming the housing and having in the central portion thereof a suction opening **2**. The body **1** is provided with the suction mouthpiece **3** and the connection member **4** serving to attach the suction brush to the suction tube of a vacuum cleaner or the like. Brush bristles **5** are arranged inside the housing **1** in various rows somewhat concentrically to the suction opening **3**. From the outer edge of the housing **1** extends a thin-walled ring **6** in the downward direction which encloses the greater portion of the brush bristles **5**, holds them together and serves on the other hand to protect the same. All parts **1** to **4** and the part **6** of the brush form a unit which consists of elastic material, preferably rubber.

WILHELM WEIMERS.

PUBLISHED

APRIL 27, 1943.

BY A. P. C.

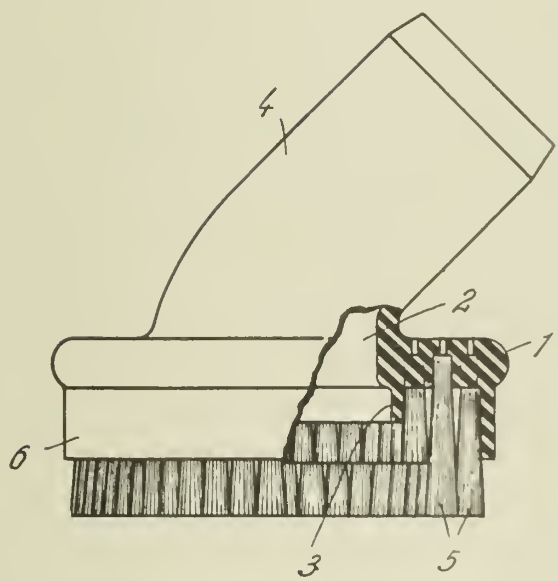
W. WEIMERS

SUCTION BRUSH FOR VACUUM CLEANERS

Filed Feb. 16, 1938

Serial No.

190,794



Inventor

Wilhelm Weimers

by Knight Bros

Attorneys

Published Apr. 27, 1943

Serial No. 191,168

ALIEN PROPERTY CUSTODIAN

HOT FORGING

Fritz Singer, Starnberg, Germany; vested in the Alien Property Custodian

Application filed February 18, 1938

This invention relates to a new and improved hot forging process for the manufacture of metal articles, such, for example, as gears, and an important feature therein consists in permitting the material of which the teeth of the gears are formed to flow beyond the finished form of the teeth in a direction other than opposite to the direction of applying the forging pressure.

Gears of ordinary or alloy steels, to which materials this invention is particularly applicable, are produced even today almost exclusively by cutting tool operations, such as machining or milling, despite the fact that this method is expensive, involves a considerable waste of material, and additionally, produces gears the grain or fiber formation of which does not conform to modern technological requirements.

Heretofore it has repeatedly been proposed to produce gears by hot forging in dies. When this was attempted, however, it was found that metals, the forging of which is rather difficult, such as steel and steel alloys, set up a high resistance to deformation and thereby prevented the complete filling in of the space of the dies to be occupied by the teeth. Accordingly, even when employing the highest pressure forces the formation of the teeth left much to be desired. The enormous power requirement and the excessive stress on the tools connected therewith caused the economy of the hot forging method to appear of doubtful benefit so that the method has heretofore been made use of only in special cases.

A method of hot forging gears has heretofore become known according to which the die and the punch are so shaped that an opportunity is afforded to the material to spread beyond the finished tooth-form simultaneously in two direction viz. in the direction of the punching pressure, as well as in the opposite direction. However, as may be demonstrated by punching holes in round metal blocks, the material, when it is given the opportunity to rise up vertically opposite to the direction of the punching pressure, sets up by far less resistance to displacement in this direction than to displacement in the direction of or transversely of the punching pressure, and accordingly, no successful or exact shaping of the teeth can be achieved by this prior method.

According to the present invention, the obstacles which have heretofore stood in the way of the general use of hot forging in the manufacture of gears have been eliminated. By giving the material an opportunity to spread beyond the finished form of the teeth, except in a direction opposite to the direction of the punching pressure, not only is an accurate filling in of the tooth-form achieved but also the power requirement and the wear on the tools are considerably reduced. In contrast to the known methods, according to which a die exactly corresponding to the finished form is produced, it is true that the novel method herein disclosed embodies the disadvantage of a slight excess consumption of material which is formed on the ends of the teeth. This drawback, however, is insignificant and it is more than counterbalanced by the advantage that results from an exact filling in of the teeth-forms with substantially less power consumption and an important saving in the cost of the tools. Even in accordance with present-day practice forged gears are customarily subjected to a subsequent machining operation, and accordingly, the slight excess machining necessary for removing the excess material that is formed on the teeth in accordance with the practice of the present invention has practically no importance.

The gear blanks forged hot with slight excess dimensions are brought to exact dimensions by a cold drawing operation. By the cold drawing not only the highest degree of accuracy of shape but simultaneously a cold hardening of the sides of the teeth may be achieved.

Other objects and features of the invention will become apparent from a reading of the following specification in the light of the accompanying drawings, in which

Figure 1 is a vertical section of the tool with a billet or work piece inserted therein;

Figure 2 is a plan view of a gear that may be produced by the arrangement shown in Figure 1;

Figure 3 is a view similar to Figure 1 showing the parts in position at the completion of a forging operation;

Figure 4 is a vertical view in section similar to Figure 1 showing the parts at the commencement of a forging operation for the production of a beveled gear having a central bore;

Figure 5 is a view in vertical section of the parts shown in Figure 4 with the punch in position at the completion of the forging operation;

Figure 6 is a top plan view of a forged beveled gear produced by the arrangement illustrated in Figures 4 and 5; and

Figure 7 is a top plan view in section taken along the line 7—7 of Figure 4.

As shown in the drawings, a base plate 10 resting on the bed or frame 12 of the press is provided with a container 14 the inner wall of which is formed with tooth-like projections 16,

the shapes of which correspond to the shapes of the teeth formed on the gear illustrated in Figure 2. Located within the central recess of the container 14 is a die block 18 in the form of an insert and the outer surface of the die is provided with teeth 19 of the same shape as the teeth of the gear shown in Figure 2. The teeth 19 have interlocking engagement with the toothed recesses 16 formed in the wall of the container 14, by means of which arrangements rotary displacement of the die block 18 relatively to the container is adequately prevented. The die block 18 is cut away or beveled at 20, 22 to form an annular recess into which excess material of the teeth of the gear may spread during the forging operation. This latter feature is illustrated in Figure 3, as will be more fully described hereinafter. Located directly above the container and adapted to engage therein is a punch 24 provided with a centrally mounted plunger 26, the purpose of which is to descend through a central opening formed in the work piece 30 and enter the bore 32 of the die block 18, as shown in Figure 3. The punch 24 is likewise provided with gear teeth 32 on its exterior surface which are adapted to mesh with the recesses 16 formed on the inner wall of the container.

In operation the heated work piece 30, which may be termed a billet, slug or the like, is placed in position within the container 14, whereupon the punch 24 and plunger 26 descend. The plunger 26 enters the bore 32 of the lower die block and as the working face of the punch strikes the work piece it forces the latter to flow laterally into the recesses 16 formed on the inner wall of the container 14 and also allows excess material to flow downwardly and laterally or transversely, as shown in Figure 3, to occupy the annular recess formed in the die block 18. By means of this provision the teeth of the gear, as illustrated in Figure 2, are firmly and completely formed. Thereafter the surplus material which flows into the annular recess of the die block 18 may be removed by milling, machining or the like.

In order to remove the completed gear from the container 14 there is provided a movable ram or ejecting device 36 which is arranged for vertical movement. As this member ascends the gear is moved upwardly until it emerges from the mouth of the container and may thereupon be removed manually.

In Figures 4 to 7, inclusive, is shown a similar arrangement by means of which a beveled gear may be produced. As therein illustrated, the container 14 is provided with a recess 38, the shape of which conforms to the shape of the beveled gear to be produced. Mounted on the container is a hollow steel cylinder 40 which initially receives the work piece or billet 30. The punch 24 is provided with the customary plunger 26, the latter being adapted to descend through the opening in the work piece and into the bore 32 of the container 14. The container is provided with radially extending slots or apertures 42 which permit the material of which the teeth are formed to spread laterally or transversely to the direction of the punching pressure beyond the finished tooth-form.

In operation the punch descends from the position that it occupies in Figure 4 until it strikes the work piece and causes it to flow into the position that it occupies in Figure 5. As shown in the latter Figure, the teeth of the gear, which in their finished form will be defined by the dotted line 44, have spread laterally through the radial openings or slots 42 and in this condition form surplus portions 50, 50 which may be seen in Figure 5 and also may be seen in Figure 6. These projections or this excess material may be removed by cutting or machining operations which do not cause any substantial additional work in the finishing operation of the beveled gear.

FRITZ SINGER.

PUBLISHED

APRIL 27, 1943.

BY A. P. C.

F. SINGER

HOT FORGING

Filed Feb. 18, 1938

Serial No.

191,168

2 Sheets-Sheet 1

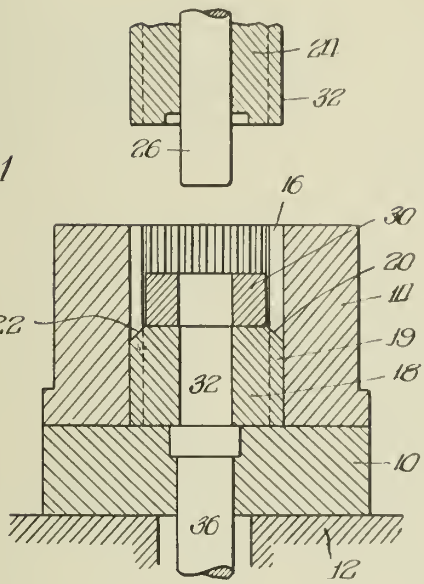


Fig. 1

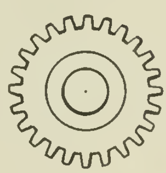


Fig. 2

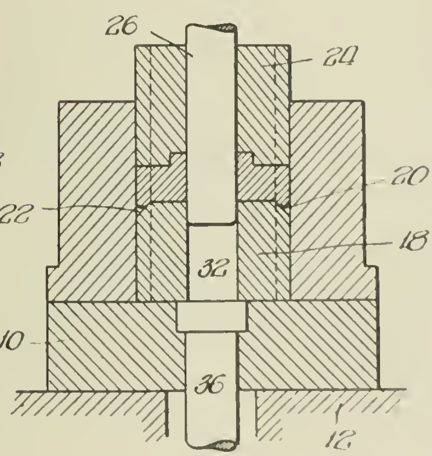


Fig. 3

Inventor:
Fritz Singer,
By Richard Spencer
atty

PUBLISHED
APRIL 27, 1943.
BY A. P. C.

F. SINGER
HOT FORGING
Filed Feb. 18, 1938

Serial No.
191,168
2 Sheets-Sheet 2

Fig. 4

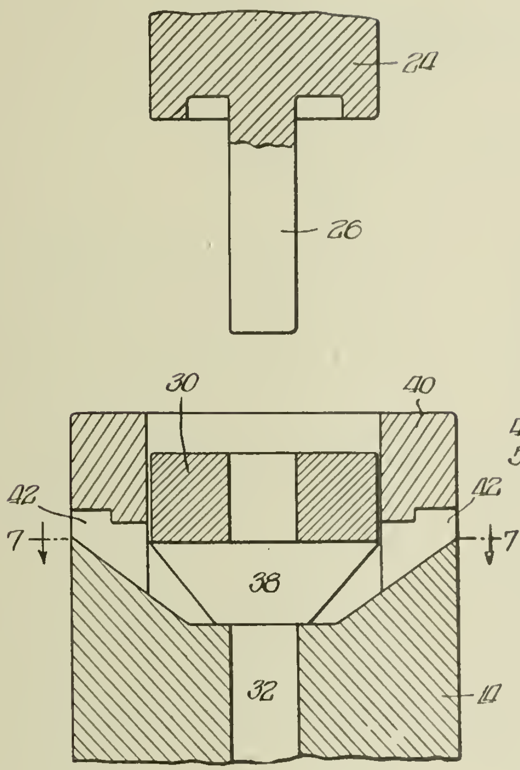


Fig. 5

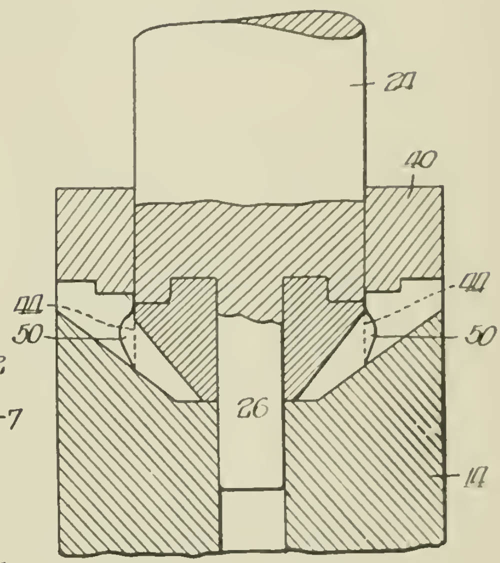


Fig. 6

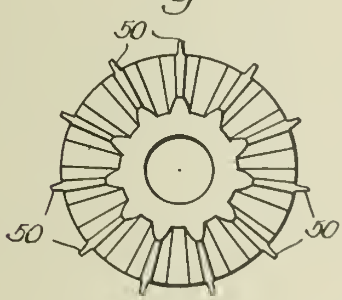
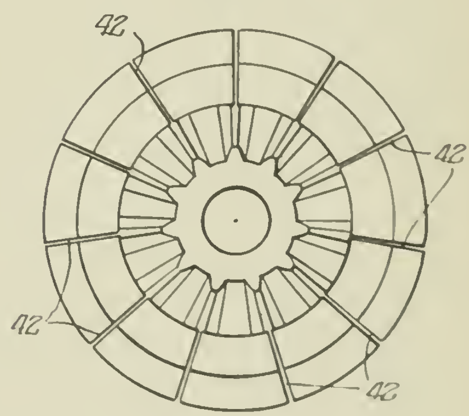


Fig. 7



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Published Apr. 27, 1943

Serial No. 196,776

ALIEN PROPERTY CUSTODIAN

PROCESS AND APPARATUS FOR THE CONTINUOUS SPINNING OF FILAMENTS AND RIBBONS FROM QUARTZ AND OTHER REFRACTORY OXIDES

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Application filed March 18, 1938

The manufacture of filaments and ribbons from quartz and other refractory oxides offers great difficulties owing to the high melting point of these materials and, hitherto, it was only by means of a discontinuous process that quartz filaments of a few metres' length could be produced. According to that process, a quartz rod subjected to tensile stress was at one place heated up to its melting point. In consequence of this the fused piece of quartz was flung away, at the same time carrying with it a quartz filament from the place of fusion.

According to the present invention fibres or ribbons of any thickness and in practically unlimited length can be produced. According to the invention the primary material after being fused or plastified by heat is continuously drawn-off from the place of fusion at a great speed in a stretch spinning process, care being taken that the primary material is delivered to the place of drawing-off at a greatly reduced speed, as compared with the spinning speed, and with a much larger cross section, as compared with the cross section of the filaments.

In addition to quartz in its transparent and opaque form, other refractory oxides having glass forming properties, such as zirconium oxide, or mixtures of various refractory oxides can be used for the process. In the process according to the invention the primary material must not necessarily be in form of glass. Furthermore, it is not necessary for the primary materials to be heated till they are fluid; on the contrary, in many cases it will be sufficient to heat the material somewhat above its softening point, so that it just exhibits plastic properties.

According to the cross section exhibited by the primary material at the place of melting, or according to the cross section given to the fused primary material at this place, there can be obtained filaments of the most varied cross sectional shapes, such as ribbon-shaped filaments which incidentally exhibit particularly good mechanical properties. Hollow filaments and hollow ribbons can also be obtained if the primary material, as conveyed to the place of drawing-off, exhibits a corresponding cross section.

Filaments with a ribbon-shaped cross section, however, can also be obtained by rolling out filaments of somewhat larger circular cross section, for example, of 100μ, preferably while they are still in a plastic state. Thereby, the filament of larger diameter obtained in a first stretch spinning operation is introduced into the rolling device either directly, i. e. while still in a plastic condition, or after being heated once more until becoming soft.

In lieu of smooth rolls, fluted or engraved rolls can also be used which impart a desired surface design to the surface of the ribbon to be produced.

The filaments or ribbons obtained according to the process of the invention being very flexible, elastic, and of great tensile strength, they can be twisted and worked into fabrics by weaving and knitting according to the usual methods of the textile industry.

In order to produce ribbons or foils of any width, the filaments or ribbons obtained are cut, for example, worked into staple filaments and felted. The felted mass is shaped into ribbons or foils. By means of rolls it can be rolled out to any desired width or thickness. Subsequently, the mass is heated in a kiln, while at the same time pressing or rolling it, whereby the individual filaments are welded together at their places of contact.

It is more advantageous to mix the felted quartz wool with an organic binder, such as dissolved nitrocellulose, and to mould the plastic mass thus obtained into a ribbon by rolling or pressing. During or after the moulding, the plastic ribbon is solidified by a hardening or drying process till it can be reeled or piled up. Subsequently, the ribbon is passed through a furnace, wherein the binder is burned and the filaments are welded together under pressure.

In an embodiment of the process, by way of example, quartz staple filaments are mixed with an organic binding agent. The felted and solidified mass is continuously passed through a rolling mill and rolled out to a thickness about ten times the thickness of the finished ribbon. Preferably the rolling is carried out at about 150°C. The temperature depends on the solvent used. The solvent evaporates and the rolled ribbon becomes so strong that it can be manipulated. The solidified ribbon is then passed through the burning chamber proper, for example, an electric furnace, wherein the binder is burned, and the felted quartz filaments are welded together by pressure. One may proceed in such a manner that the ribbon, immediately beyond the highest zone of heating, is passed through a pair of rolls which welds the filaments together by pressing, while they are still plastic.

It is particularly advantageous to pass the ribbon through electrically heated rolls. Owing to the radiation of the rolls which are heated to about 1000–1700°C and more when quartz is to be

worked into filaments, the binding agent burns off before the ribbon enters the rolls. The ribbon thus produced, directly after the rolling cools down sufficiently, so that permanent changes of shape by the stress of the reeling-up will be prevented.

By special shaping of the rolls, any desired cross section of the ribbons can be obtained. Thus, cylindrical rolls produce a more rectangular cross section, while curved rolls produce a more elliptical cross section.

If very thin ribbons or foils are to be rolled, it is preferred to card the staple filaments or the wool, prior to or after the treatment with the binding agent. Hereby, a more or less parallel orientation of the filament pieces is achieved. As an example, a rotating carding machine cards a thin fleece of quartz wool which is continuously lifted from the carding machine and passed through the binding agent. The fleece impregnated with the binder then passes through a preliminary wringer whereby the excess of the binding agent is removed; then through a preliminary drying device, if desired, which by partial evaporation of the solvent imparts to the ribbon a more consistent quality; then through the rolling device proper wherein the ribbon is rolled to measure. Then the ribbon passes through the drying stove where the remainder of the solvent is evaporated entirely. Therefore, the ribbon reaches the kiln where the binder is burned and the filaments are welded together under pressure. On leaving this furnace the ribbon is reeled-up, passing through cutting machines, if desired.

According to the method of carding, ribbons of widely differing degrees of density are obtained. It is possible to produce both porous and practically imporous ribbons.

The ribbons obtained are translucent to transparent. When having a corresponding thickness they are exceedingly flexible. If, for example, vitreous quartz filaments of a diameter of 1μ are used and a thickness of 5μ is chosen for the ribbon, such ribbons are readily suitable to be wound round very fine wires without risk of breaking. The length of the individual filaments, when staple filaments are being used, may range from a few mm to many cm.

The connection of the ends or edges of the ribbons and foils is best effected by welding. For special purposes, for example, electrical purposes, foils or ribbons can be provided on one or on both sides, wholly or partly, with a metal layer, for example, by means of the cathode spluttering process.

It is particularly advantageous to impregnate the ribbons or foils produced according to the present invention, when they are to be used for electrical purposes, with preferably organic insulating materials, such as higher saturated hydrocarbons, paraffins, ceresins, cholesterines, styrols, polymerisation products of the most varied kind, cellulose derivatives, and the like. As an example, highly porous finished ribbons are dipped into liquid ceresin, while taking the precautions customary in impregnating. After the ribbon has imbibed the impregnating agent and the excess of the impregnating agent has been removed, for example, by means of a wringer, the ribbon is dried and can readily be used as an insulating covering for cables.

In lieu of immersing the whole ribbon in the impregnating agent, one can treat it, on one or both sides, with the impregnating agent by means of a distributing roller. If the impregnating agent is applied to one side only, the other side of the ribbon can be coated with metal.

The great technical advantage of these ribbons resides in their high strength and in the good electrical properties of the organic insulating materials.

In the following examples we have set forth the stretch spinning process according to the invention and devices for carrying it out, but they are presented only for purposes of illustration and we do not wish to limit ourselves in respect of the devices illustrated in the examples.

Figure 1 illustrates diagrammatically a stretch-spinning device for producing quartz filaments.

Figure 2 shows the furnace used, by way of example, for heating the raw material.

Figures 3 and 4 illustrate modified embodiments of stretch-spinning devices.

According to Figure 1 of the accompanying drawings the end of the quartz rod **1** is brought to softening temperature in a closely confined heating zone of the smelting furnace **2**, and the quartz filament drawn off from the end of the rod is wound round a rotating winding device, for example, the roller **3**. In proportion to the quartz filament being spun from the end of the quartz rod, the rod is passed into the smelting furnace by means of a feeding device consisting of the rack **4** in which the rod is secured by means of a chuck, and the cog-wheel **5**. The higher the speed of rotation of the winding device 3, the more material is drawn off from the end of the rod and the more quickly must the feeding device feed the rod. The thickness of the drawn-off quartz filament, at a given feed of the material to be spun, depends upon the speed of the rotating winding device, it being necessary, in the case of a very high speed, for the raw material to be highly softened accordingly, with a view to obtaining sufficient fluidity, so that the filament will not break off.

If a quartz rod circular in cross-section is being used, the spun quartz filaments will exhibit a cross-section of the same kind. If the quartz rod used is rectangular or elliptical in cross-section, a quartz ribbon is obtained. When quartz tubes are used hollow filaments or ribbons are obtained. The quartz rod may consist of transparent or opaque vitreous quartz. Moreover, a quartz rod produced by means of any sintering process may likewise be used.

In an example carried out in practice, a quartz bar circular in cross-section and of 3 mm diameter was used; the rate at which the quartz rod was fed into the device, was 1 cm per minute and the rate of winding round the roller was 900 m per minute. Thus, the ratio of the rate at which the raw material was fed, to the spinning rate was 1:90,000; this involves a reduction in cross-section by $\sqrt{90,000}=300$. The cross-section of the quartz filament obtained was obut 7 μ, accordingly. As winding devices that rotate still more rapidly, can readily be operated, it is possible to produce considerably thinner filaments such as filaments having a cross-section of only $\frac{1}{2}$ μ or less.

For producing exceedingly fine filaments the work may be carried out in stages; thus at first a fairly thick thread is produced, then this thread is fixed in the feeding device and drawn out to form a very fine thread. In all these embodiments of the invention, but also when rods are being used, a number of threads or ribbons can be spun simultaneously, if desired, by employing

one winding device, whereby one furnace as well as several furnaces may be used.

Figure 3 illustrates in some detail another advantageous embodiment of the invention. In the high frequency furnace 6 employed by way of example the receptacle 7 made of a highly refractory material, such as graphite or carbon, and containing the fused quartz 8 is employed. Dipping into the fused quartz is the tube 9 (made of graphite, carbon, thorium oxide, and the like) with the plate 10, which is provided with nozzles 11. Part of the static weight of the tube 9 is balanced by counterweights 12, which are suspended over pulleys 13. The remaining weight of the tube causes the plate 10 to sink into the melt to a certain depth only. The hydrostatic pressure of the melt then forces the molten quartz through the holes in the plate 10 into the interior of the tube 9. At the commencement of the manufacturing process the quartz plunger 14, which is secured in a metal tube suspended from the spring 15, is brought into contact with the threads entering the tube 9, by bending the spring; as soon as contact is made between the plunger 14 and the inflowing quartz mass the spring 15 is caused to leap up, whereby the threads extruded from the nozzles are drawn out. These threads are then laid over the winding device 16 and reeled up thereon.

Threads of different diameter are obtained according to the speed with which the winding device 16 is moved. Reeling speeds of from 500 to 3,600 m per minute and more were employed. By suitably adjusting the weights 12 it can be attained that the tube 9 with the nozzle plate 10 will sink into the melt in proportion to the spinning of threads from said melt, so that there is a constant hydrostatic pressure at the nozzle openings.

The diameters of the nozzles are many times larger than the thickness of the quartz filaments produced, for example, 3 mm as compared with a diameter of the filaments of 3 μ. The thickness of the threads is not determined by the apertures of the nozzle plate but by the stretching operation. The spun quartz filaments may be given a great variety of cross-sectional shapes by shaping the nozzles accordingly; hollow threads or ribbons, for example, may thus be obtained.

In the embodiment of the invention according to Figure 3 a plurality of threads is spun from the melt simultaneously, according to the number of nozzles provided.

In the apparatus according to Figure 1 as well as in that according to Figure 3 a feeding device is used which conveys the raw material to the place of drawing-off at a rate that is considerably lower than the drawing-off speed of the filaments, and furthermore there is employed a rotary drawing-off device such as a reel whose speed determines the thickness of thread and which is destined to receive the spun filament. In both devices the cross-section of the raw material which is determined in the device according to Figure 1 by the cross-section of the quartz rod used, and in the device according to Figure 3 by the cross-section of the apertures of the nozzle plate, is considerably greater than the cross-section of the quartz filaments produced.

Figure 4 illustrates a modified construction of the stretch-spinning device. The fused quartz is forced under pressure through a nozzle plate 3 (spinneret), made of carbon, tungsten carbide, graphite, or a similar refractory material which, however, is an electric conductor, the nozzle plate itself being used as heating element. For this purpose current supply leads 35 and 36 are provided. In order to utilize the heat effectively, only that part of the quartz mass to be spun is fused or plastified by heating which is nearest to the nozzle plate. This part of the quartz mass is extruded through the nozzles by pressure, for example by the pressure of the quartz mass with which it is weighted. The plastic or liquid parts of the quartz mass extruded from the nozzles are drawn off by means of a device such as shown in Figure 3 and wound round the roller. It will be seen from Figure 4 that the graphite plate 31 is substantially thinner at the point 32, whereby the electrical heating energy is concentrated at this point. Part 32 is provided with holes that are advantageously from 2 to 4 mm in diameter, and forms the spinneret of the apparatus. Above 32 in the chamber 33 quartz sand, for example, is placed, protected by a heat insulation 39 or an electrical insulation 37. If the electrical circuit is closed, the spinneret will be heated to a temperature corresponding to the voltage applied, and, if said temperature is high enough, it will fuse the quartz sand in the chamber 33 just above 32. Owing to the static pressure exerted on the melt by the quartz sand above it, the melt passes through the nozzles of the plate 32 and enters the chamber 41; in this chamber the quartz that is forced through is grasped by any suitable device, drawn off, and wound on a drum.

The above described stretch-spinning device renders it possible to attain, under economic conditions, a particularly high drawing-off rate, (for example 4,000 m per minute and more).

The filling up with quartz sand in this embodiment is particularly simple as the quartz sand can be poured into the chamber 33 from above by means of suitable devices, the level being kept constant as near as possible.

In order to reduce as much as possible the loss by radiation in the spinneret on the side not facing the melt, it is advantageous to build up the spinneret of two or more layers of different materials that are electric conductors, such as carbon and graphite, in such manner that the layer nearest to the fusing mass is a better electric conductor than the outer layer. Hence, a stronger electric current will flow through this layer, and make it hotter than the side opposite to the fusing mass. It is particularly advantageous to provide the side of the spinneret opposite to the fusing mass with a layer of a heat insulator such as zirconium silicate.

It is preferred to work in a neutral atmosphere, for example, by passing nitrogen into the chamber 33 and 41.

Whereas in the device according to Figure 1 the raw material is heated to just above softening point and is in a viscous state, in the embodiment according to Figures 3 and 4 the melt is comparatively fluid.

For softening or fusing the raw material smelting furnaces are used which permit of being adjusted to a correspondingly high temperature and easily regulated. For example, there may be employed electric resistance furnaces, high frequency furnaces, coal dust furnaces, rod furnaces, Tammann furnaces, and furnaces heated by a oxyhydrogen or oxygen blowpipe.

Sometimes it may be advisable, particularly when using coal burning furnaces, to pass nitrogen, argon or other inert gases through the furnace in order to protect the furnace materials, or it may be advisable to cover or impregnate the

structural parts exposed to high temperatures and to the air with protective substances.

Figure 2 illustrates by way of example the construction of an electric furnace that can with advantage be used in conjunction with the device according to Figure 1.

To the burner **20** made of graphite or carbon current is supplied, on the one hand through the head **21** of the furnace, and on the other hand through the jacket of the furnace that consists of the tube **22** of carbon or graphite, and through the intermediate member **23**. The two current supply leads are electrically insulated from each other by the porcelain or asbestos insulation ring **24**. Current is supplied to the head-piece **21** through the copper bolt **25** and to the jacket **22** through the copper clamp **26**. The burner **20**, the head-piece **21** and the intermediate member **23** are perforated to allow the passage of the quartz rod from which the quartz thread is to be spun. If the quartz rod is inserted from the top such a distance that its end extends a little way beyond the hottest part of the heating zone, the end of the quartz rod extending beyond the hottest zone will fuse immediately the current is switched on, whereupon it drops, taking a thread with it, and in this way commences the spinning operation.

In order to avoid losses by radiation and for the purpose of protecting the carbon parts of the furnace the interior of the heating chamber **2** is provided with porcelain tubes **27** and **28** which at the same time prevent the access of atmospheric oxygen.

At a given cross-section and length of the nozzles there is given for each temperature of the melt a drawing-off rate calculable from Poiseuille's equation. When this drawing-off rate is adjusted accordingly, the viscosity of the melt has to be constant, if the apparatus is to work perfectly, since otherwise, in the event of the viscosity increasing, too little of the melt would flow through the nozzle, and the threads would become thinner and thinner, and finally snap off. Likewise, in the event of the viscosity dropping (i. e. the temperature rising) there would be derangements, as increasingly more of the melt would be delivered than is required with the fixed drawing-off rate and the diameter of filament desired. Two conditions may arise: Either the diameter of the filament becomes greater or there appear in the thread, in the event of sudden sharp changes in viscosity, so called "fishes" (short, much thickened portions of thread). In both cases a rational spinning manufacture would be subject to undesirable stoppages.

All these difficulties can be avoided by carefully controlling the amount of heat (electrical energy) supplied and/or the drawing-off rate and/or the pressure exerted on the melt. The refractory oxides, more especially quartz, show sometimes very undesirable property, viz. an extremely high temperature sensitiveness of the viscosity, particularly in that range of temperature in which the work is carried out on economical grounds. Spinning experiments bear this out very clearly. There is always an endeavour to employ as low temperatures as possible because, apart from the not unconsiderable technical difficulties involved in employing a temperature that is only 100°C higher than is absolutely necessary (in the high range of about 2,000°C and over) the loss of heat increases very rapidly. The lower the temperatures at which spinning can still be carried out, the greater are the changes in viscosity with the temperature, so that to spin economically special attention must be given to temperature and drawiing-off rate. Further, on grounds of economy, the nozzle constants, the viscosity (temperature), the pressure and the drawing-off rate must be adjusted to optimum conditions.

For this purpose different steps may be taken. Since generally the electric resistance of the electric heating element employed in the different stretch-spinning devices increases continuously, the electric energy must, if a constant voltage is used, be altered in accordance with the alteration of the electrical resistance of the heating element. Arrangements can be made either so to control the current that it is constant; then only in the first approximation is the same effect obtained. Or better still, the energy itself is controlled. In the first case an ammeter is coupled with a control motor through a relay in such manner that when the current drops the control motor causes a main control device that acts for example on a step transformer, to furnish a higher voltage, and vice versa. In the second case, a watt-meter is used instead of an ammeter.

It is also possible, by means of the ammeter or watt meter through relays or other devices to influence the speed of rotation of the winding machine. The rate of the influence required can be deduced from Poiseuille's equation.

Finally, the pressure can be controlled by which the melt is forced through the nozzles. The simplest manner of controlling is to put the receptacle containing the melt under the pressure for example, of a gas cylinder provided with a reducing valve. Since in practice in nearly all processes nitrogen is used as rinsing gas, it is advisable to keep the receptacle containing the melt under the pressure of a nitrogen atmosphere. It is then possible to control the reducing valve through relays by means of the ammeter or wattmeter, i. e. to increase the pressure with a decreasing supply of electrical energy, and vice versa. As it is not possible to go beyond a certain pressure, it is advisable, beyond a certain pressure, to control the drawing-off rate that has hitherto been constant.

It will be understood that still other combinations of controlling are possible. Thus, for example, it is possible to regulate to a constant current intensity and to a certain gas pressure. Finally it is possible, up to a certain limit, to regulate to a constant electric energy supplied, whereupon the pressure is regulated up to a further limit and finally the drawing-off speed is also regulated.

Since the filaments produced by the process according to the invention are often charged electrostatically it is advisable to discharge them before they are wound; this can be effected, for example, by passing them through a bath of an electrolyte.

As already explained, the filaments produced are remarkable by high elasticity and tensile strength. They can without difficulty be twisted to threads by all the methods customary in the textile industry. Filaments with a diameter of less than 5μ show considerable knotting strength.

As quartz has a very low dielectric loss ($tg\delta$ about 1×10^{-6}), the quartz filaments, ribbons and foils produced according to the invention are very suitable for insulating wires and cables and particularly for insulating conductors of high frequency currents. They are furthermore suit-

able as dielectric in condensers. Quartz ribbons, such as can readily be produced by the process of the invention in cross-sectional ratios of from 1:2 to 1:100 and over, are particularly useful. Such quartz ribbons are far superior to the materials hitherto used for this purpose such as silk, ethyl cellulose, polystyrol, and the like.

As the new quartz filaments and ribbons may be produced in any length desired and are very elastic they can be readily woven into fabrics to be used for the most varied purposes, for example, fabrics in which particular importance is attached to their being permeable to ultra-violet rays, acid-proof, fire-proof, etc.

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PUBLISHED

APRIL 27, 1943.

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PROCESS AND APPARATUS FOR THE CONTINUOUS SPINNING OF FILAMENTS AND RIBBONS FROM QUARTZ AND OTHER REFRACTORY OXIDES

Filed March 18, 1938

Serial No. 196,776

Fig.1

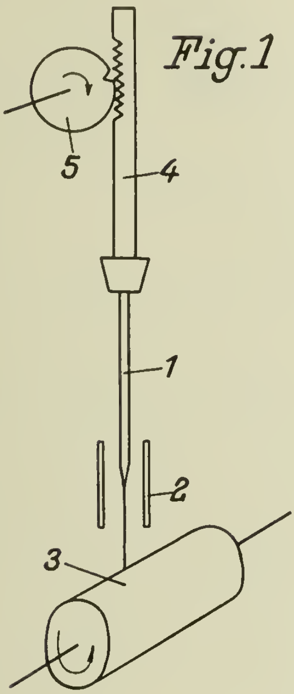


Fig.3

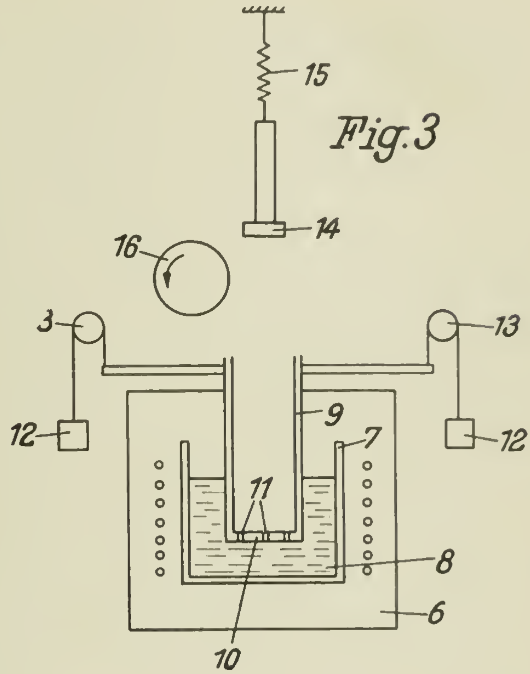


Fig.2

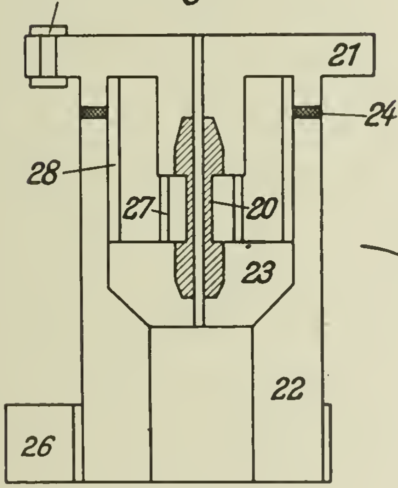
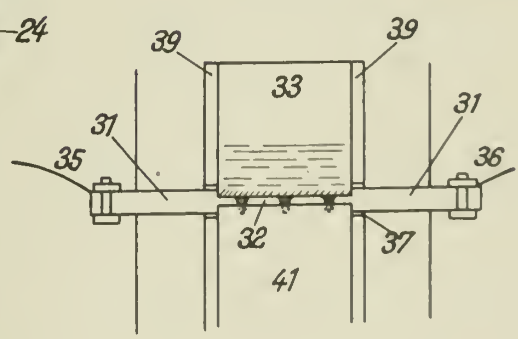


Fig.4



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Published Apr. 27, 1943 Serial No. 197,564

ALIEN PROPERTY CUSTODIAN

SPINNING NOZZLE

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Application filed March 23, 1938

This invention relates to spinning nozzles for use in spinning filaments such as artificial silk and the like.

Spinning nozzles have been made of various kinds of materials, and it has not only been proposed to make the nozzle body and the perforated nozzle plate of separate parts held together, but it has also been proposed to make them of two different materials.

The principal object of the present invention is to improve that type of nozzle in which the nozzle body and nozzle plate are made of separate parts, and particularly where they are made of two different materials, by increasing the resistivity of the nozzle plate. This renders it possible to make the nozzle plate quite thin even when relatively high spinning pressures are used. High spinning pressures are desirable as they reduce the tendency of the nozzle openings to clog, and if clogging does take place the high pressure makes it possible to more readily clear the openings.

The invention is of particular importance in cases where non-metallic nozzle plates are required as, for instance, in spinning unripened viscose, casein solutions and the like. The invention is also of particular value, and has a wide field of application, in cases where the nozzle plates are required to have a large number of apertures in order to permit the spinning to take place in as small a space as possible with a minimum number of operators.

In accordance with the invention the nozzle plate is given the shape of a truncated cone. In other words, the edge portion of the nozzle plate is tapered so that the diameter of the plate at the inner face is greater than its diameter at the outer face. The holder in which the nozzle plate is mounted has a correspondingly tapered seat to receive the nozzle plate. The angle which the tapered edge forms with the base is kept quite large, for example, 60°. If this angle is made too large the resistance of the nozzle plate to pressure is reduced, a point which is of special importance when the plate is made of ceramic material, glass, or some artificial substance such as hard rubber or the like.

In cases where the nozzle plate is quite thin, the edge portion of the plate may be flanged toward the inside of the nozzle and the flange itself may be given the conical shape. This form of construction is particularly desirable when the nozzle plate is made of thin metal but where a nozzle plate of more than 2 mm. thickness is employed the flange may be omitted, if desired.

The insertion of the perforated nozzle plate may be effected in various ways according to the material used, for example, by grinding in, pressing in, or rolling in. If the nozzle plate is of particularly thin material and has a conical shaped flange at its edge portion, as described above, the plate may be further strengthened and its resistivity increased by the use of a cross element suitably connected to the perforated portion of the plate.

A number of embodiments of the invention are illustrated in the accompanying drawings, in which:

Figure 1 is a vertical section through a nozzle body having the nozzle plates mounted therein in accordance with the invention;

Fig. 2 is a plan view of Fig. 1;

Fig. 3 represents a portion of Fig. 1 drawn to a larger scale;

Fig. 4 is a view corresponding to Fig. 3 showing a nozzle plate whose edge portion is formed into a conical flange;

Fig. 5 is a view corresponding with Fig. 3 showing a sheet metal nozzle plate which is pressed in place and whose edge portion is formed into a conical flange;

Fig. 6 is a view corresponding to Fig. 3 showing a sheet metal nozzle plate which is rolled in place and whose edge portion is formed into a conical flange;

Fig. 7 is a vertical section of a nozzle body having a thin nozzle plate whose edge portion is formed into a conical flange and which is strengthened and reinforced by a cross element connected to the perforated portion of the nozzle plate;

Fig. 8 is a vertical section of a nozzle illustrating the improved manner of mounting the nozzle plate when the nozzle body is in the form of a cap screw threaded on to the spinning pipe;

Fig. 9 is a vertical section of a nozzle illustrating the manner in which several of the improved nozzle plates may be mounted in the capnut type of nozzle shown in Fig. 8;

Fig. 10 is a horizontal section of a nozzle showing the manner in which a large number of perforated nozzle plates may be mounted in a common holder-plate and supplied by a common feed line;

Fig. 11 is a vertical section through a similar nozzle illustrating the manner in which the common holder-plate may be maintained seated; and

Fig. 12 is a transverse section through a similar nozzle illustrating a detail of the means for maintaining the common holder-plate seated.

Referring to Figs. 1, 2 and 3, the nozzle body 1

may be provided with a flange 2 to enable it to be attached to the spinning pipe in the usual way. The nozzle body is provided with any required number of cylindrical bores represented at 3, 4, 5 and 6. The lower end of each bore is tapered to provide a conical seat for a nozzle plate. The perforated nozzle plates are indicated at 7, 8, 9 and 10. As best shown in Fig. 3 the edge portion of each nozzle plate is tapered as indicated at 11. In other words, the nozzle plate has the form of a truncated cone. The taper on the nozzle plate corresponds with the taper at the lower end of the bore so that the nozzle plate seats snugly and firmly in the conical seat which receives it. Each nozzle plate is provided with a number of holes 12 varying according to the size of the plate.

In the case of thinner nozzle plates the edge portion of the plate is formed into a conical shaped flange shown at 13 in Fig. 4. The conical or tapered flange fits snugly and firmly in the conical seat on the nozzle body. When the nozzle plate is made of thin sheet metal with a peripheral tapered flange it may be pressed in as shown at 14 in Fig. 5, or may be rolled in as shown at 16 in Fig. 6. In the latter case the peripheral flange on the nozzle plate has a bead 15 rolled into a corresponding annular groove in the conical wall of the seat on the nozzle body.

In Fig. 7 the nozzle body 17 is provided with a single large bore having at its lower end a conical seat into which a comparatively thin nozzle plate is rolled, the plate having a peripheral tapered flange 18. To enable the nozzle plate to withstand the spinning pressure, it is provided with a cross element 20 which is connected by means of a stay bolt 21 to the perforated portion of the nozzle plate. Thus the nozzle plate is firmly held not only at its edge portion but is also held at the center of the perforated portion.

The member in which the nozzle plate is mounted need not be a nozzle body of the kind shown in the figures so far described but may be in the form of cap-nut D shown in Fig. 8. In this case the feed pipe A terminates in a spinning head B which is threaded at C so that the cap-nut may be screwed onto it. The cap-nut D is provided with a conical seat G to receive the tapered edge of the perforated nozzle plate F. A specially formed packing ring E is inserted between the spinning head B on the one hand, and the lower portion of the cap-nut and the nozzle plate on the other hand. This packing ring has a flat peripheral portion and a conical projection which fits as exactly as possible in the conical seat on the cap-nut.

In Figure 9 the arrangement is quite similar to that shown in Figure 8, but in this case the cap-nut carries a number of perforated nozzle plates F instead of one. The lower portion of the cap-nut has a tapered seat G for each of the nozzle plates. In this case the packing ring E is shaped and positioned as indicated in the drawing.

Particularly appropriate for the large scale manufacturer of artificial spinning filaments is an arrangement in which a large number of nozzle plates are mounted in a common holder-plate which in turn is suitably mounted in a spinning head connected directly with the feed pipe. Such an arrangement is shown in Figures 10, 11 and 12. In Figure 10 a number of nozzle plates F are mounted in a common holder-plate H. Each nozzle plate is tapered at its edge as previously described and the holder H is provided with tapered seats for receiving the nozzle plates. The feed pipe is shown at A, and B indicates the enlarged spinning head into which the holder plate H is suitably mounted. Each plate may have a great many apertures, for example, 1500 or more. A nozzle of this type may be used not only for producing artificial spinning filaments in large quantities but may also be used for making artificial silk in which case the individual perforated nozzle plates may be provided with a smaller number of holes corresponding to the number of artificial silk filaments.

Figure 11 shows one way in which the holder-plate H may be mounted in the spinning head. The plate H may be made tight by the packing E against which this plate is pressed by a spring I or a screw K, or both. During operation of the nozzle the seating of the plate H on the packing E is effected by the spinning pressure within the nozzle. Figure 12 illustrates how the pressure of the spring I may be distributed to the side portions of the plate H and further shows that the lower face of the plate H may be made flush with the bottom of the spinning head B, if so desired.

In all forms of the nozzle herein described, the pressure of the spinning solution within the nozzle forces the nozzle plates firmly against their seats and no additional fastening means is ordinarily required. However, if desired each perforated nozzle plate may be cemented in place. As an example of a cement suitable for the purpose may be mentioned one having a lamp black base which is acid and alkali resistant and which melts at about 80–120° C. Any other suitable cement may, of course, be used such as rubber cement.

It will be noted that in Figs. 1 to 9 inclusive the individual perforated nozzle plates are mounted directly in the nozzle body or in the cap-nut whereas in Figs. 10 to 12 inclusive, they are mounted in a common plate which in turn is mounted in the spinning head. In any case the member in which the individual perforated nozzle plates are mounted constitutes a holder for the plates.

BERNHARD WEMPE.

PUBLISHED	B. WEMPE	Serial No.
APRIL 27, 1943.	SPINNING NOZZLE	197,564
BY A. P. C.	Filed March 23, 1938	2 Sheets-Sheet 1

Fig. 1

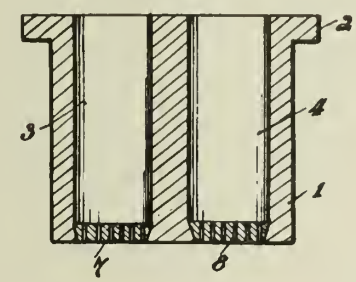


Fig. 3

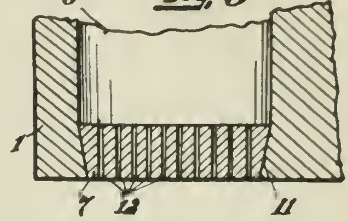


Fig. 2

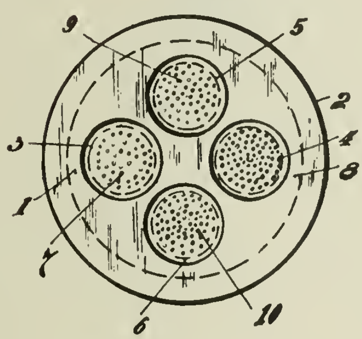


Fig. 4

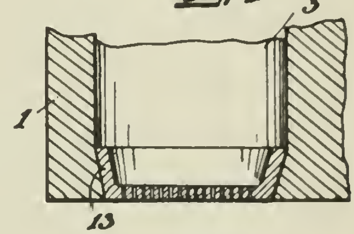


Fig. 5

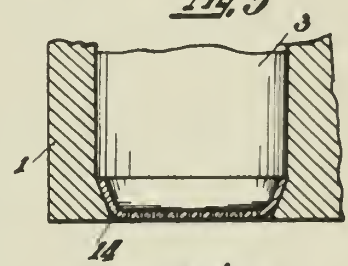


Fig. 6

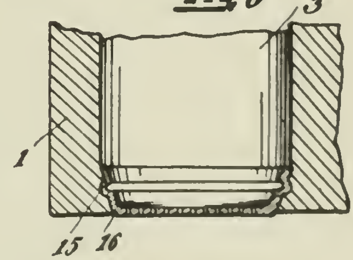
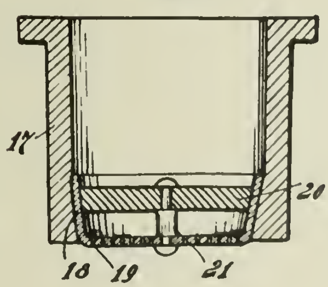


Fig. 7



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ATTORNEYS

PUBLISHED	B. WEMPE	Serial No.
APRIL 27, 1943.	SPINNING NOZZLE	197,564
BY A. P. C.	Filed March 23, 1938	2 Sheets-Sheet 2

Fig. 8

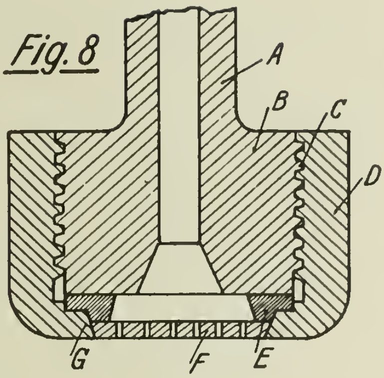


Fig. 9.

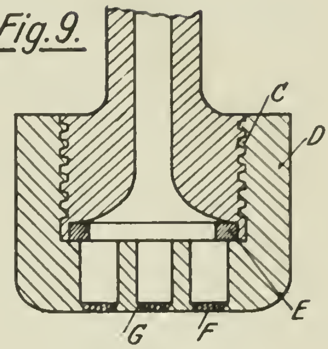


Fig. 10

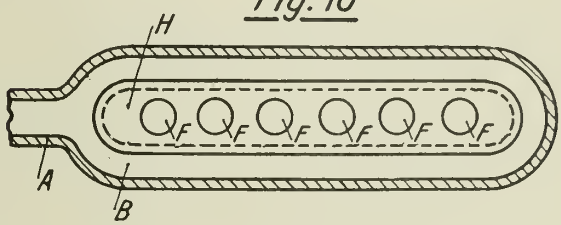


Fig. 11

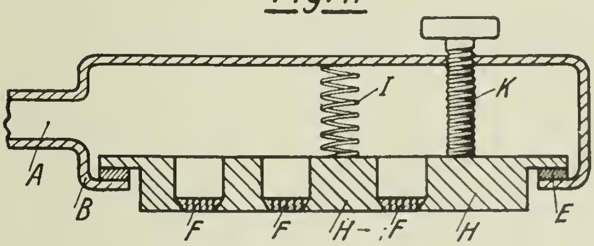
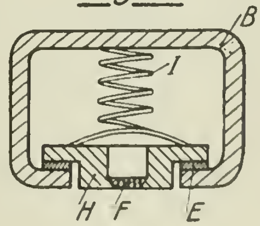


Fig. 12



INVENTOR

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ATTORNEYS

Published Apr. 27, 1943

Serial No. 203,137

ALIEN PROPERTY CUSTODIAN

MANUFACTURE OF ELECTROLYSER CELL FRAMES

Ewald Zdansky, Berlin-Schoneberg, Germany; vested in the Alien Property Custodian

Application filed April 20, 1938

Various methods have been proposed for producing cell frames for electrolysers of the kind comprising a plurality of cell frames assembled to a unitary structure after the fashion of a filter press.

Some of these methods involve casting the individual frames of cement or cement mixture. Such frames are not sufficiently dense and moreover are not sufficiently strong. If the frames are bounded with metal, a certain stiffening results in addition to imperviousness outwardly, but the absolutely necessary tensional and compressional strength is not increased. Further, the frame must be packed and insulated towards the electrolyte by means of interposed layers of rubber. Owing to lack of sufficient strength these frames are not used in practice.

It has also been proposed to produce the frames of impervious and insulating materials, particularly lacquer solutions and to add thereto filling substances, including cement. The purpose of the filling substances is to give the materials, which are liable to soften under heat, a certain stiffness even at higher temperatures. Forming is effected in heated moulds under pressure, but previously the solvent has to be evaporated and the mass has to be disintegrated in disintegrating machines. The moulding itself is effected progressively in a plurality of operations, drying being effected between the operations. This method enables insulating bodies of sufficient compressional strength to be produced, but it is expensive and complicated and can only be employed in connection with thermoplastic mixtures.

Objects of the present invention are, firstly to provide an improved and simplified method of manufacturing electrolyser cell frames, and secondly, to obtain by this method cell frames all of one and the same profile such that the frames can be simply pressed or held together to constitute the cells under assurance that their juxtaposed surfaces make sealing engagement.

The method comprises mixing a cement-asbestos mass with the addition of water, or water with other binding and densifying liquids, and pressing it under high pressure and at normal temperature into a profile mould, insertions of metal or other suitable material being incorporated in the moulded mass for increasing its strength.

The moulded mass is insulating- and heat- and lye-resistant.

Experiments have shown that the addition of bitumen to the mass also gives good results.

Conveniently the method is carried into effect as follows:

The materials are mixed directly prior to the moulding operation with the addition of water or some other setting and densifying liquid. The mass is prepared in a quantity just sufficient for the moulding of one frame. In order to obtain a homogeneous mixture it is convenient to effect the mixing with an excess of water. Shortly before the moulding operation the excess water is removed and half of the mass is uniformly distributed in a profile mould. The strength-increasing insertion is then introduced and the rest of the mass placed in position. Then the mass in the mould is subjected to high pressure in a press to complete the moulding operation whereafter the moulded mass or cell frame is ejected from the mould and is placed temporarily into a separate setting frame to ensure perfect setting without warping and deformation. During setting the moulded frames are frequently watered, or they may be allowed to set under water.

A mixture of 10–50% of asbestos, 10–35% of limestone and 50–80% of cement has proved satisfactory.

The high moulding pressure results in such density of the structure that packing of the frames outwardly or towards the electrolyte is unnecessary. Frames made in this manner are very dense and are of great tensional and compressional strength.

Metal wires welded to rings or formed into spirals, metal strips, wire netting or profiled sections and the like may be employed as insertions, but if it is desired to avoid metal, insertions of asbestos fabric or asbestos string or similar material may be employed.

The invention embraces electrolyser cell frames produced by the aforesaid method and each having the same profile, namely projections on one side surface and aligned, corresponding grooves or recesses in the other side surface, enabling two frames to be assembled in self-sealing juxtaposition to constitute a cell.

A ledge-forming recess for the reception of a diaphragm or an electrode is preferably formed in the surface presenting the aforesaid projections, whereby all fixing means for the diaphragm or electrode and the hand labour otherwise necessary for the fixing are avoided.

In spite of each cell being formed by two frames, a separate packing can be dispensed with altogether owing to the novel frame profile, i. e. to the adoption of projections and recesses. It

is sufficient simply to apply a coating of paint-like composition and to press the frames together to obtain an absolutely reliable gas- and liquid-tight seal. For this coating a mass of bitumen or a mixture of bitumen with other filling substances, such as asbestos, cement or talcum, has proved eminently satisfactory.

Since the two frames necessary for one cell and referred to as anode and cathode frames, are perfectly alike, with the exception of the gas outlets hereinafter referred to, production costs are considerably reduced. Further, since the insertion and fastening of the electrodes and of the diaphragms is very simple and can be effected without tools owing to the aforesaid ledge-forming recesses, considerable saving in the cost of assembly can be made having regard to the great number of individual cells necessary for a battery. However, the main advantage is the saving of at least two packing surfaces as compared with the known cell construction with divided cell frame of profiled iron and the saving of special packing.

A form of cell and the frames thereof made according to the invention are illustrated by way of example on the accompanying drawing, whereon:—

Fig. 1 shows the cell in front elevation;

Fig. 2 represents a fragmentary section, on the line A—B of Fig. 1, through only one of the two frames of the cell:

Fig. 3 represents a fragmentary section, on the line C—D of Fig. 1, through only one of the two frames, namely the anode frame;

Fig. 4 represents a fragmentary section, on the line E—F of Fig. 1, through only the other of the two frames, namely the cathode frame; and

Fig. 5 shows in section the assembly of the two frames.

Each cell is formed by two identically profiled frames **1** provided with two gas outlet channels **2,3** and with an electrolyte channel **4** extending therethrough. The two frames differ only in that in one, the anode frame, connection from the interior of the cell is established to the channels **2** and **4** by ducts **5** and **7** respectively, whereas in the other, the cathode frame, connection from the interior of the cell is established to the channels **3** and **4** by ducts **6** and **8** respectively. The connecting ducts **5** and **7** to the gas collector channel **2** and the electrolyte channel **4** are disposed at the front side of the pertaining frame (see Fig. 3) while in the other frame (see Fig. 4) the connecting ducts **6** and **8** to the gas collector channel **3** and the electrolyte channel **4** are disposed at the rear side. The number of the connecting ducts is immaterial. It will be understood that when a number of frames are juxtaposed to form a battery of cells the individual channels **2,3,4** are aligned to constitute three through channels.

Each frame is profiled to present on one side surface projections and packing ledges denoted **9** and in the other side surface aligned and conforming recesses or grooves **10**. Four such projections and recesses are shown. **11** is an inner ledge-forming recess into which alternatively a diaphragm **13** or an electrode **14** (Fig. 5) may be inserted. The uppermost projection **9** and the uppermost groove **10** are deeper than the rest to facilitate the assembly of the cell frames and to render relative displacement of the frames impossible. **12** indicates the iron rings which serve as insertions for the press-moulded frame.

Fig. 5 shows clearly how the projections **9** and grooves **10** interengage and how the tightness of the cell is ensured by coating with a sealing substance as hereinbefore mentioned. It will also be seen how displacement is prevented by making the upper groove **10** and projection **9** deeper than the rest.

EWALD ZDANSKY.

PUBLISHED APRIL 27, 1943. BY A. P. C.

E. ZDANSKY

MANUFACTURE OF ELECTROLYSER CELL FRAMES

Filed April 20, 1938

Serial No. 203,137

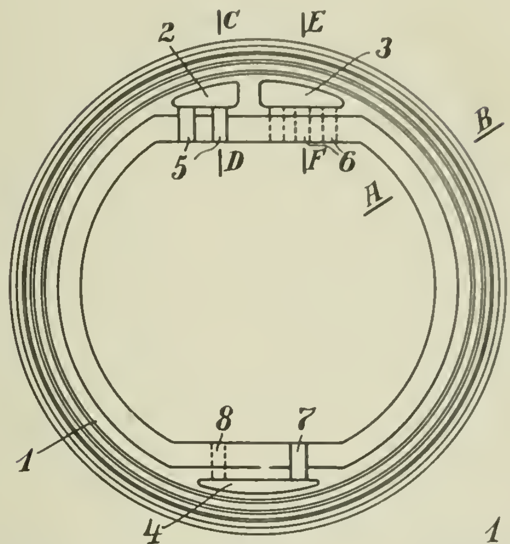

Fig. 1

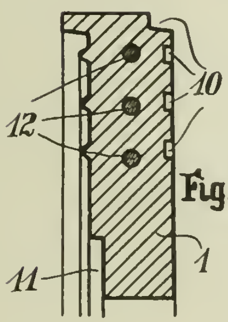

Fig. 2

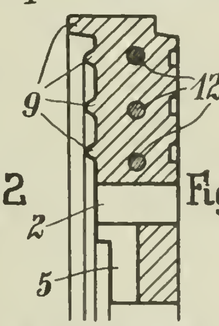

Fig. 3

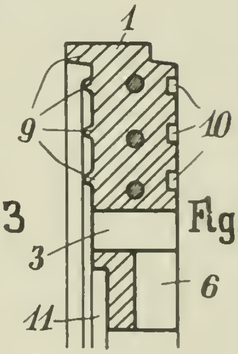

Fig. 4

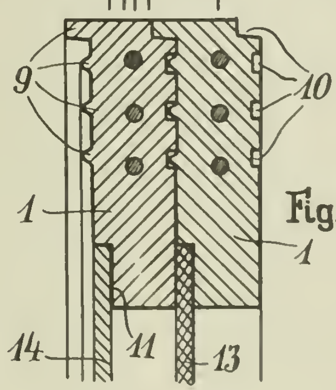

Fig. 5

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Inventor

By John B. Brady
Attorney

Published Apr. 27, 1943

Serial No. 203,714

ALIEN PROPERTY CUSTODIAN

METHOD OF PRODUCING ARMOURED CONCRETE

Ewald Hoyer, Berlin-Halensee, Germany; vested in the Alien Property Custodian

No Drawing. Application filed April 22, 1938

As is known, the normal armoured concrete has a very small transverse or tensile strength and a small elasticity. Besides, the consumption of iron is relatively high. According to recent proposals, it has been tried to improve the resisting properties of armoured concrete by maintaining a preliminary tension in the armour until the concrete is hardened, using straight iron rods and subjecting the rods to a preliminary tension of 40 to 60 kgs. per mm². Although by this preliminary tension a certain preliminary compressive tension is obtained, it has not been possible to substantially improve the known properties of armoured concrete. Nor did this result in a material reduction of the quantity of iron consumed. Furthermore, the connection of the iron with the concrete is insufficient with these pre-tensioned rods, which have to give the concrete a relatively great tensile strength. This insufficient connection is due to the fact that the rods have a relatively small surface and that these rods are loosened inside the concrete owing to dynamic stresses caused by their inherent vibration. The small adhesive strength of the iron rods in the concrete makes it necessary to brace the rods in the concrete especially at the ends. Owing to this bracing, pieces of concrete with pre-tensioned armour can only be made in certain lengths. This limitation is also governed by the limited length of the iron rods available for armouring purposes. If girders of greater lengths or the like are required, the iron rods have to be welded or joined together in order to obtain the required length of armouring.

Even if, as mentioned above, high quality steel of a greater strength is used for armouring, it is not possible, as will be shown below, to obtain substantial preliminary tensions in the concrete, as elastic jumping of the concrete as well as contracting and shrinking causes a great reduction of tension in the armour rods. As the maximum preliminary compressive tension obtainable is 150 kgs. per cm² with a modulus of elasticity $E_b=140000$ kgs. per cm², the compressive strength of the concrete is utilised only to a very small degree, the concrete admitting a much greater preliminary tension.

The method according to the invention is distinguished from the above mentioned method of production by using thin, highly refined steel wires with a diameter of 0.5 to 2 mm, for example, and with a very great tensile strength of up to about 30000 kgs. per cm², the wires being subjected to a very great preliminary tension, about equal to the final tensile strength required, until the concrete is hardened.

These refined high carbon steel wires which, as is known, are drawn to this thickness possess apart from their extremely high tensile strength a great hardness and a small elongation of rupture of only 2 to 5%. It is the type of steel wire which is also used as piano wire and for wire ropes, but in the present case it is used in its natural raw state, i. e. unpolished. These steel wires have a tensile strength of about 12000 to 30000 kgs. per cm². They are very elastic and the very high limit of stretching strain amounts to about 90% of the tensile strength. If double safety is calculated with, these steel wires may by subjected to a permanent safe tension of about 5000 to 14000 kgs. per cm².

The method according to the invention enables to produce armoured concrete which may not only be regarded as a substantially improved ferroconcrete but represents a new building material of quite different properties. With the new method a building material of low iron contents is obtained which contains only 10% of the iron armour in normal ferroconcrete. By using steel wires of very high tensile strength, a preliminary compressive tension of up to about 800 kgs. per cm² can be obtained in the concrete which at the same time corresponds with the safe tensile strain of the concrete. This armoured concrete may therefore be regarded as to a high degree resisting extension and bending. As the steel wires used are made in any desired length, it is possible to make extraordinarily long pieces of concrete, their length being nearly unlimited, without welding the inserted armouring. Very long pieces of armoured concrete, e.g. girders, can be made by the new method and can then be sawn into single pieces of any desired size, e.g. single girders. This sawing does not in any way alter or impair the resisting properties.

A considerable advantage of the new method may be seen in the fact that no bracing of the armouring is required, i.e. that smooth drawn wires may be used.

In order to work out the new method, great difficulties had to be overcome. It did not at all suggest itself to the expert to use thin, highly refined steel wires for this purpose, besides, it seemed impracticable to use such highly pretensioned wires for producing armoured concrete.

Hitherto, only highly alloyed steels were known possessing a strength of up to 120 kgs. per mm². Though it was known that highly refined steel wires have a greater tensile strength, it was thought that this great strength, produced by refining, would only be temporary and that these wires would not be suitable for permanent strains, as their strength is weakened by symptoms of fatigue and as they were liable to a certain amount of permanent stretching. However, exact experiments have proved that a permanent strength actually exists in the case of these highly refined steel wires and that only if they are

subjected to a load of above 80% of the tensile strength, a reduction of strength and a certain amount of stretching occurs. The invention is therefore based on the knowledge that highly refined steel wires withstand a great permanent tension and are thus rendered suitable with regard to their strength for producing armoured pre-tensioned concrete.

In addition, the invention recognises the fact that, contrary to iron and steel rods, thin highly pretensioned steel wires do not require bracing. Experts could not assume that smooth, highly tensioned thin wire should not require bracing in the concrete, as highly pre-tensioned armour rods made bracing indispensable. Therefore, it was thought that thin, smooth, drawn wires would slip into the concrete when the latter is hardened and the tension at the ends of the wire is removed, and that, in consequence of the small adhesive strength of the wires, the tension of the wires could not be conferred to the concrete. But, just on the contrary, exact experiments have proved the adhesive strength of the wires, used for armouring, to be very great, whereas the adhesive strength of rods is so small as not to be sufficient to confer the tension to the concrete.

The following calculation is to show the preliminary compressive tension which may be obtained in the concrete in the case of the known methods as compared with the new method. These preliminary compressive tensions are equal to the final tensile strength of the concrete.

Let be:

σ_{evx} the preliminary tension of the steel armour before being conferred to the concrete,

σ_{ev} the permanent tension acting in the steel armour after the tension has left off,

V_x the decline of tension occurring:

(a) owing to the elastic jumping ϵ_b of the concrete,

(b) owing to the shortening δ_1 of the concrete caused by contraction, and

(c) owing to the sortening δ_2 of the concrete caused by subsequent shrinking.

σ_{bv} the preliminary compressive tension produced in the concrete,

E_e, E_b the modulus of elasticity of iron and concrete respectively.

The decline of tension V_x in the steel armouring is:

$$V_x=\sigma_{evx}-\sigma_{ev}$$

The elongation ϵ_e of the steel, which equals the decline of tension V_x:

$$\epsilon_e=\frac{V_x}{E_e}=\frac{\sigma_{evx}-\sigma_{ev}}{E_e}$$

must be equal to the jumping ϵ_b of the concrete

$$\epsilon_b=\frac{\sigma_{bv}}{E_b}$$

from which follows:

$$\frac{\sigma_{bv}}{E_b}=\frac{\sigma_{evx}-\sigma_{ev}}{E_e}$$

Introducing the value

$$n=\frac{E_e}{E_b}$$

we have:

$$n\,.\sigma_{bv}=\sigma_{evx}-\sigma_{ev}$$

This equation shows the connection between the necessary preliminary tension σ_{evx} and the preliminary compressive tension σ_{bv} in the concrete. It is to be seen that it is independent of the degree of armouring.

If the moduli of contraction, shrinkage, and elasticity are known for the respective concrete, it is possible to find the maximum preliminary compressive tension σ_{bv} max of the concrete independent of the cross section of the concrete.

Then, in the equation, the value of the limit of stretching strain σ_{es} must be put for σ_{evx}, and the value σ_{ev} for the permanently acting steel tension. The value $\sigma_{es}-\sigma_{ev}$ represents the value of the decline of the tension.

The equation for the maximum preliminary compressive tension of the concrete becomes:—

$$\sigma_{bv}\ \max=\frac{\sigma_{es}-\sigma_{ev}}{\frac{E_e}{E_b}}-\frac{\delta_1+\delta_2}{\frac{1}{E_b}}$$

The first part on the right of the equation gives the value of the preliminary compressive tension of the concrete without regard to the contraction and shrinkage. The second part represents the value of the contraction and of the shrinkage.

If rods of ordinary constructional steel are used for armouring with a limit of stretching strain $\sigma_{es}=2400$ kgs. per cm², with a safe load of $\sigma_{ev}=1200$ kgs. per cm², and using concrete with $E_b=140\,000$ kgs. per cm², with a modulus of contraction $\delta_1=0.0005$ cm/cm, and a modulus of shrinkage $\delta_2=0$, the maximum preliminary compressive tension of the concrete at the maximum preliminary tension σ_{es} of the armouring becomes:

$$\sigma_{bv}\ \max=10 \text{ kgs. per cm}^2$$

If high quality constructional steel with a limit of stretching strain $\sigma_{es}=3600$ kgs. per cm² and $\sigma_{ev}=1800$ kgs. per cm² is used for the same concrete, the maximum preliminary compressive tension is σ_{bv} max=50 kgs. per cm².

For rod armouring of steel with maximum strength (chromium-nickel-steel) having a tensile strength of 11,000 to 12,000 kgs. per cm², and a limit of stretching strain $\sigma_{es}=8000$ kgs. per cm², and $\sigma_{ev}=4000$ kgs. per cm², we get for the same concrete with a modulus of shrinkage $\delta_2=0.0003$ cm/cm:

$$\sigma_{bv}\ \max=153 \text{ kgs. per cm}^2$$

It is pointed out that the maximum preliminary compressive tension of the concrete cannot be increased by adding to the quantity of armouring or by decreasing the cross section of the concrete.

In comparison with the foregoing calculation of the preliminary compressive tension of the concrete, the maximum preliminary compressive tension is calculated, resulting, if, for example, steel wire according to the invention is used with $\sigma_{es}=24{,}000$ kgs. per cm² and $\sigma_{ev}=12{,}000$ kgs. per cm², when these pre-tensioned wires are imbedded in a very resisting concrete with a modulus of contraction $\delta_1=0.0004$ cm/cm and a modulus of shrinkage $\delta_2=0.0004$ cm/cm. Using these values, the maximum preliminary compressive tension of the concrete becomes

$$\sigma_{bv}\ \max=688 \text{ kgs. per cm}^2$$

If a very high quality concrete is used, for which E_e is somewhat greater than 140,000, it is possible to obtain a permanent preliminary compressive strength of up to 800 kgs. per cm².

The following will serve to prove that concrete armoured according to the invention with steel wires, can be produced, in which the steel wires are imbedded without any bracing. The fact that the highly tensioned wire confers its tension to the concrete is partly due to the very large surface of numerous relatively thin wires, contrary to the case when rods are used. In addition, when cutting off the tensioned wires, the diame-

ter at the ends of the wires is enlarged owing to the transverse extension, whereby the steel wires are pressed against the concrete. The friction between the wire and the concrete, set up by these compressive forces, prevents the wires from being drawn into the concrete, as will be seen from the following calculation.

Let be:

d_0 the diameter of the pre-tensioned wire,

d_1 the enlarged diameter of the wire after the decline of tension,

m_b, m_e Poisson's values for concrete and steel respectively.

The enlargement of the diameter of the wire from d_0 to d_1 causes in the concrete the compressive tension:

$$\sigma_{ro}=\frac{m_b . E_b}{m_b+1}\cdot\frac{\sigma_{evx}-\sigma_{ev}}{E_e . m_e-\sigma_{evx}}$$

The frictional resistance R_1 for 1 cm length of wire is:

$$R_1=f\cdot\sigma_{ro}\cdot U$$

where f represents the coefficient of friction between steel and concrete, and U the circumference of the wire.

For the length of adhesion λ the frictional resistance is derived from:

$$R_2=\int_{x=0}^{x=\lambda} f\cdot\sigma_{rox}\cdot U\cdot dx$$

where

$$\sigma_{rox}=\frac{m_b . E_b}{m_b+1}\cdot\frac{\sigma_{evx}-\sigma_{ev}\cdot\frac{x}{\lambda}}{E_e . m_e-\sigma_{evx}}$$

The tensile force acting in the wire inside the concrete is:

$$Z=F\cdot\sigma_{ev}$$

When R is greater than Z, the wires cannot be drawn in anymore. Therefore, the length of adhesion is:

$$\lambda=\frac{2\cdot F}{U}\cdot\frac{1}{f}\cdot\frac{m_b+1}{m_b}\cdot\frac{E_e\cdot m_e-\sigma_{ev}}{E_b}\cdot\frac{\sigma_{ev}}{2\cdot\sigma_{evx}-\sigma_{ev}}$$

For example, having $f=0.25$; $m_b=6$; $m_e=3$; $E_b=300{,}000$; $E_e=2{,}100{,}000$; $\sigma_{evx}=15{,}000$ kgs. per cm^2; $\sigma_{ev}=12{,}000$ kgs. per cm^2, we find:

$$\lambda=33\cdot d$$

and with a threefold safety against sliding:

$$L=100\cdot d$$

The lengths of adhesion λ and L respectively therefore are:

$d=1$ mm $\lambda=3.3$ cm $L=10$ cm
$d=3$ mm $\lambda=10.0$ cm $L=33$ cm
$d=5$ mm $\lambda=16.5$ cm $L=50$ cm
$d=10$ mm $\lambda=33.0$ cm $L=100$ cm
$d=20$ mm $\lambda=66.0$ cm $L=200$ cm

This comparison proves that bracing the ends of the thin wires, as used according to the invention with thicknesses of 0.5 up to a maximum of 5 mm, may be omitted, which however is not possible when using wires or rods with a thickness exceeding 5 mm, as the length of adhesion is too great.

The application of the new method requires a very resisting concrete with a compressive strength of 400 to 1200 kgs. per cm^2, which is densified by using fine-grained additions and high quality special cement, and by agitating, especially at high frequencies of 50 to 150 Hz. Using the above mentioned values, the maximum compressive tension between the wire and the concrete at the free end of the wires is for example $\sigma_{roo}=615$ kgs. per cm^2, whereas towards the interior this tension drops to a certain value, amounting to only $\sigma_{ro}=123$ kgs. per cm^2 at the end of the length λ of adhesion. These compressive tensions in the concrete are independent of the diameter of the wire and are therefore of the same magnitude for all thicknesses of wire.

The armour wires according to the invention are given a preliminary tension by using any desired means, for example winches, the wires being tensioned singly or in groups, for example combined in a rope, according to the purpose. The wires are subjected to a great preliminary tension, sufficient to cause an elastic elongation of the wires of 3 to 10 mm per metre.

The adhesive strength is very great when using thin steel wires and is not impaired by inherent vibrations as in the case of rods, the mass of the wires being too small. As in the case of wires the length of adhesion required to confer the preliminary tension to the concrete is very small, the larger pieces of concrete produced according to the new method, for example girders and plates, may be readily sawn into small or short pieces. As many thin wires pass through the concrete produced according to the new method, the plastic deformation of the concrete in conferring the tension is reduced to a minimum, and an extremely homogeneous building material is obtained, behaving similar to iron.

The above mentioned small elongation of drawn steel wires, being 2 to 5%, keeps the concrete armoured with these wires, elastic nearly up to the point of rupture, so that this concrete may be regarded as completely elastic, capable of being stressed by up to 1½ times the safe load without forming fissures. The rupture does not, as in the case of the known ferroconcrete, occur suddenly, but commences for example with a great deflection when subjected to bending stresses about 10 times as great as in the case of ferroconcrete, finally also forming fissures in the concrete. As soon as the load is reduced, these fissures close again and the deflection goes back elastically and rapidly. The concrete produced according to the new method therefore affords a great safety, as it may be stressed without damage nearly up to the point of rupture.

As experiments have shown, the concrete produced according to the new method will readily stand great and varying permanent stresses (vibration stresses), contrary to ferroconcrete. It possesses a permanent strength also in the case of dynamic stresses and may be used in cases where ferroconcrete is unserviceable. The new method may be applied to all concrete constructions. According to the new method, new types of high buildings as well as halls and bridges with great spans can be made of elastic concrete, in a way which has not been possible hitherto.

The elastic concrete is of special importance as a new material in the manufacture of articles made of concrete. It is possible to produce girders of any desired shape or length, serving as a substitute for iron girders. Besides, all kinds of plates as well as new articles can be produced, which hitherto could not be made of concrete. Water pipes and pressure chambers can be made for the highest interior pressures of up to about 200 atmospheres. They are so elastic and durable that fissures in the concrete do not occur.

This concrete is also suitable as a material for railway sleepers of great durability, being superior to iron sleepers.

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Published Apr. 27, 1943

Serial No. 206,948

ALIEN PROPERTY CUSTODIAN

PROCESS AND APPARATUS FOR THE MANUFACTURE OF ARTIFICIAL SAUSAGE SKINS

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Application filed May 9, 1938

This invention relates to the manufacture of tubular products, particularly suitable for use as artificial sausage skins, by extruding swollen fibrous masses, particularly animal fibrous masses, through annular nozzles.

It has been found that the felted fibres of these masses, which are very viscous, on extrusion through relatively narrow annular nozzles, have a tendency to align themselves in the direction of flow owing to friction against the shaping nozzle parts. Accordingly the fibres for the greater part become disposed parallel in the axial direction of the tube, whereby the strength of the tubular structures is impaired.

A process for the manufacture of artificial sausage skins from animal fibrous masses has already been proposed, in which the fibrous mass is extruded in a plastic kneadable condition through annular nozzles in such a way that the fibres are displaced on their passage through the nozzles in intersecting directions. The necessary displacement or arrangement of the fibres in intersecting directions for strengthening the sausage skins is effected by subjecting the fibrous masses during their passage through the annular nozzles to the action of rotating nozzles parts.

The present invention provides another method of obtaining sufficiently strong tubular structures. The process of this invention consists substantially in subjecting the fibrous mass during its passage through the nozzle to so strong a pressure (de-swelling pressure) that partial de-swelling of the fibrous mass temporarily takes place and effecting the displacement of the fibres whilst the mass is in this de-swollen condition.

As a result of this partial de-swelling a condition is arrived at, in which more or less considerable movement of the fibres against one another takes place, the fibres as it were "floating" in the liberated water, so that displacement by mechanical means, for example direction-imparting elements, can be particularly successfully effected in the nozzle.

Immediately the de-swelling pressure falls, the expressed water at once re-combines with the fibres, so that a tube now issues from the nozzle, the fibres of which are fixed in an intersecting direction. This procedure takes place in the interior of the nozzle, where the desired high pressure prevails. An even only partially de-swollen mass cannot issue from the nozzle, because at the end of the nozzle the pressure again reverts to atmospheric pressure.

When employing stationary nozzles, the requisite de-swelling pressure may for example be produced by employing nozzles of considerable length. In such nozzles the resistance to the passage of the pasty fibrous mass becomes so great, that at a certain position within the nozzle a pressure is produced which brings about the de-swelling of the mass. A zone is accordingly formed in which free water occurs, which enables the individual fibre particles to take up any desired position or to become variously disposed relatively to one another in accordance with the direction-imparting elements disposed in the nozzle.

Various means may be used for promoting the deflection of the fibres in different directions in the flowing mass.

The fibrous mass during its passage through the annular nozzle may be subjected to the action of direction-imparting elements or members, such as bores, ribs, grooves, alterations in the cross-section of the annular nozzle opening etc. Nozzles may also be employed, the walls of which are provided with helical tracts, preferably of high pitch. In certain cases a plurality of elements as aforesaid may be used in conjunction in order to deflect the fibres. The aforesaid elements must of course be so constructed and disposed that the fibres are deflected to the necessary extent for effecting strengthening of the tube.

The fibrous mass may be influenced in the desired manner by suitable construction and arrangement of the direction-imparting elements. The fibres may for example be deflected in different layers of the flowing mass, for example in such a way that the fibres in the outer layer of the flowing mass are deflected in one direction and those in the inner layer in the opposite direction, whilst the fibres in the intermediate layer are practically not affected or only slightly affected. Alternatively considerable displacement of the fibres may be effected, for example in such a way that the fibres become extensively interlaced or felted. The flowing mass may for example also be divided into individual thread- or band-shaped streams, which before leaving the nozzle are re-combined to form closed tubular products. In this case the bands or threads in the outer layer may, for example, be deflected in one direction and those in the inner layer in the opposite direction.

In order to effect transverse displacement of the fibres in the zone of the water expressed or liberated from the fibrous mass, a nozzle may for example be employed, the annular space of which becomes enlarged in the direction of flow of the fibrous mass. Such a nozzle accommo-

dates a larger quantity of the mass at its outlet position than at the inlet position. Consequently the mass becomes dammed up in the nozzle, as a result of which some of the fibres becomes displaced transversely to the direction of flow. The fibres are accordingly in part displaced from their parallel alignment and at least become irregularly disposed relatively to one another, as a result of which the desired strength is imparted to the tubular product. Special direction-imparting elements may in this case also be provided in the nozzle in order to promote the deflection of the fibres.

A certain displacement of the fibres may also be achieved by reducing the annular space of the nozzles by constrictions or the like, if desired at several places. As a result thereof the fibres become dammed up and deflected in front of each constriction, whilst after passing the constriction a certain expansion takes place, which may give rise to vortex and the like movements. The part of the nozzle adjacent to the outlet position is in this case so constructed that the fibrous masses at this position acquire their final shape, wall-thickness and strength.

Satisfactory results may for example be obtained with a nozzle 400 mms. in length and 50 mms. in diameter having an annular space 0.5 mms. wide and helical grooves 1 mm. deep, 1 mm. wide and of 80 mms. pitch. Depending on the quantity of swelling water contained in the fibrous mass and the rate of travel, nozzle lengths of about 300 mms. to about 600 mms. are suitable operated at pressures of about 80 to about 300 atms. When employing a nozzle as aforesaid for a fibrous mass derived from animal hide and containing about 90% of swelling water, a pressure of at least 100 atms. is necessary with a rate of travel of 10 cms. per second. Still more favourable results are obtained if the pressure is raised to 150–250 atms.

In the case of a conically expanding nozzle it has for example been found that a nozzle 400 mms. in length and 500 mms. in diameter having an annular space which gradually increases in width from 0.2 mm. at the inlet end to 0.5 mm. at the outlet end yields satisfactory results. Such a nozzle may of course also be provided with helical grooves, which increase the effect already produced by the enlargement of the annular space. The invention is not limited to the above indicated dimensions of the conically enlarging annular space, satisfactory results being also obtained with a nozzle between 250 mms. and 600 mms. in length having an annular space which gradually increases in width from about 0.1 mm. at the inlet end to about 0.8 mm. at the outlet end.

The elements employed for displacing the fibres may be disposed in groups arranged if desired at different distances from the longitudinal axis of the nozzle. They may be disposed in the walls of the nozzle itself or in separate attachments.

A few embodiments of apparatus according to this invention are illustrated in the accompanying diagrammatic drawings, in which:

Fig. 1 is a longitudinal section through a long nozzle with helical grooves in the inner walls thereof,

Fig. 2 is a similar view to Fig. 1, but with the difference that the width of the annular space of the nozzle is conically enlarged,

Fig. 3 is a longitudinal section through a part of a nozzle provided with direction-imparting elements in the annular space thereof,

Fig. 4 is an enlarged plan view of a part of an unwound surface with fixed direction-imparting elements disposed thereon,

Fig. 5 is an enlarged cross-section along the line B—B of Fig. 3 and shows one embodiment of the direction-imparting elements,

Fig. 6 is a similar view to Fig. 5 and shows another embodiment of the direction-imparting elements,

Fig. 7 is a longitudinal section through a nozzle provided with a separate circular attachment serving to orientate the fibres,

Fig. 8 shows on an enlarged scale a part of the circular attachment of Fig. 5 provided with direction-imparting elements,

Fig. 9 is a perspective view of a part of a circular attachment provided with direction-imparting elements,

Figs. 10 and 11 are longitudinal sections through two embodiments of nozzles according to the invention,

Fig. 12 is a perspective view partially cut away of a nozzle, in which a certain displacement of the fibres is obtained by the arrangement of elements in the interior of the annular space, some of which reduce and others enalrge the cross-section of the space in the direction of flow,

Fig. 13 is a longitudinal section through a long nozzle with an annular space of uniform width,

Fig. 14 is a cross-section along the line XIV—XIV of Fig. 13, and

Fig. 15 is a longitudinal section through a long nozzle with an enlarging annular space.

Referring to the drawings, the nozzle illustrated in Fig. 1 consists of a hollow casing or jacket **1**, in which a likewise hollow cylindrical core **2** is disposed. Both parts are fixed in relation to one another. The fibrous mass passes in the direction of the arrows *a* through the tubes **3** and **3'** into the annular nozzle space **20**, from which the fibrous mass discharges in the form of a tubular product. In the embodiment according to Fig. 1 the annular space is of uniform width. The direction-imparting elements consist of helical grooves **21**, which may be disposed in the walls of the nozzle parts **1** and/or **2**. In the embodiment according to Fig. 2 the annular space **22** gradually increases in width from the inlet to the outlet end. The fibrous mass is forced under high pressure through the tubes **3** and **3'** into the annular space **20** or **22** and expressed from this space, the operation being carried out continuously. The tubular product is maintained in a stretched condition by compressed air which flows in the direction of the arrow *b*, through the hollow space **6** of the core **2**.

According to Fig. 3 the annular space **4** in which the fixed direction-imparting elements are disposed, is continued in the annular space **5**. The direction-imparting elements in the annular space **4** may be constructed in the form of grooves **7** (Fig. 4) which are separated by ribs **8**. The grooves, as shown in Figs. 5 and 6 (the grooves in Fig. 5 being rectangular and in Fig. 6 of semi-circular cross-section) are in part disposed in the jacket **1** and in part in the core **2**. It is essential that the grooves and ribs of one part should intersect those of the other part as shown in Fig. 4, the elements **7'** and **8'** of the non-visible part being indicated by dot and dash lines.

The grooves of one part, for example the jacket **1**, deflect the fibres on their passage through the annular space **4** in one direction, whilst the elements of the other part deflect the fibres in the opposite direction. Since both directions cross,

the fibres become interlaced and in part crossed above one another.

As hereinbefore described the fibres may be superimposed in layers by disposing the direction-imparting elements in groups at different distances from the longitudinal axis of the nozzle. One group, for example, comprises the elements disposed in the jacket **1** and the second group the elements disposed in the core **2**. In Figs. 5 and 6 the two groups are indicated by A and B.

In the embodiment according to Fig. 7 the fixed direction-imparting elements are disposed in a separate attachment in the nozzle. The nozzle in this case is also provided with an outlet annular space **5** and a pre-disposed annular space **9**, into which the direction-imparting elements, here shown as bores, open. These bores are disposed in the flange of a ring **10** which is inserted in the nozzle. The mass again passes in the direction of the arrow *a* and the air again in the direction of the arrow *b*. The bores are again disposed in two groups A and B in the flange of the ring **10** at different distances from the longitudinal axis of the nozzle. As shown in Fig. 8, the bores are obliquely disposed in the flange of the ring **10** and not parallel to the nozzle axis. It is essential that in the one group A the bores should proceed obliquely in the opposite direction to the bores in group B.

In the embodiment illustrated in Fig. 9 the fixed direction-imparting elements consist of small tubes **11** disposed in a support **12**. This may again be a ring or an annular flange as in Figs. 7 and 8. The tubes are disposed in bores in the support **12**, which proceed parallel to one another and to the nozzle axis. The bent-over parts **11'** of the tubes project from the holes into the discharge space of the annular space in advance thereof. These parts are again bent in different directions in two different groups A and B, so that, owing to the different distance of these groups from the nozzle axis, the fibres become disposed in layers.

In the nozzle illustrated in Fig. 10 the direction-imparting elements take the form of bores in a conical attachment **13**. These bores are again disposed in groups A and B at different distances from the nozzle axis. The mass again enters in the direction of the arrow *a* and is pressed through the bores of the groups A and B under high pressure into the annular space **4** which is disposed in advance of the outlet annular space **5** of the nozzle. The air for maintaining the tubular product discharging from the nozzle under tension is also in this case introduced in the direction of the arrow *b* into the hollow inner space.

In the nozzle illustrated in Fig. 11 an attachment is likewise provided, in which the direction-imparting elements are in the form of bores. The attachment in this case is in two parts. It consists of a hollow conical part **14** disposed in a conical bush **15**. In this case also two groups of bores or grooves are provided, group A being disposed in the inner conical surface of the bush and group B in the outer conical surface of the hollow conical part **14**. The mass enters in the direction of the arrow *a* and is passed through bores to the tapering groove-shaped bores of the groups A and B. The air enters the inner space of the nozzle in the direction of the arrow *b*. The groove-shaped bores of the attachment discharge directly into the outlet space **5** of the nozzle.

In the embodiments illustrated in Figs. 10 and 11 the bores or grooves of one group are of course disposed in an opposite direction to the bores or grooves of the other group. The fibres are thereby deflected in different directions, as in the other embodiments. The only difference is that in the embodiment of Fig. 10 the fibres are only superimposed in layers after their discharge from the attachment **13** into the annular space **4**, whereas in the embodiment of Fig. 11 the fibres may become entirely or partially so disposed inside of the attachment **14**, **15**.

In all cases more than two groups of direction-imparting elements, each disposed at a different distance from the nozzle axis, may be provided.

In all the described embodiments the fibrous mass is divided into individual thread- or band-shaped streams, which are subsequently combined in layers to form the tubular product. The parts, particularly the direction-imparting elements and the surfaces on which they are disposed, may however be so constructed that the fibrous mass traverses the direction-imparting elements already in the form of a tubular product, longitudinal projections being then formed only by ribs, grooves or the like, the direction of which in each group is different to that in the others.

In the embodiment according to Fig. 12 the fibrous material flowing in the direction of the arrow between the hollow core **2** and the jacket **1** is released from tension by the action of the grooves **16**, which proceed at right angles to the longitudinal axis or may be disposed in helicals, and is dammed up by the ribs **17**, which reduce the nozzle cross-section for certain distances. Vortex movements are produced thereby, which cause the fibres to become interlaced and superimposed, the fibres whilst in this condition passing through the outlet annular space **17** of usual cross-section and being accordingly fixed in this condition in the finished tube. The ribs and grooves may be disposed in the jacket and/or in the core. If desired they may be disposed at an angle to one another.

Two preferred embodiments of a long nozzle are illustrated in Figs. 13 to 15. In the embodiment of Figs. 13 and 14 the annular space is of uniform width and in that of Fig. 15 of gradually increasing width. The fibrous mass is pressed through the bore **3**. A longitudinal bore **6** is provided in the core **2**, through which compressed air is supplied to the tubular product discharging from the nozzle, in order to maintain the tube in a stretched condition. Helical tracts **23** and **24** are provided in the inner wall of the jacket **1** and the outer wall of the core **2** respectively. They are preferably of the same pitch but of different twist, the helical tract in the jacket having for example a right-handed twist and the outer helical **24** of the core a left-handed twist. The helical tracts are not continued to the nozzle outlet, but end a certain distance behind the same, so that the bore of the jacket **1** and the outer surface of the core **2** are smoth along the distance **25**.

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PUBLISHED
APRIL 27, 1943.
BY A. P. C.

O. W. BECKER ET AL
PROCESS AND APPARATUS FOR THE MANUFACTURE
OF ARTIFICIAL SAUSAGE SKINS
Filed May 9, 1938

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206,948
3 Sheets-Sheet 1

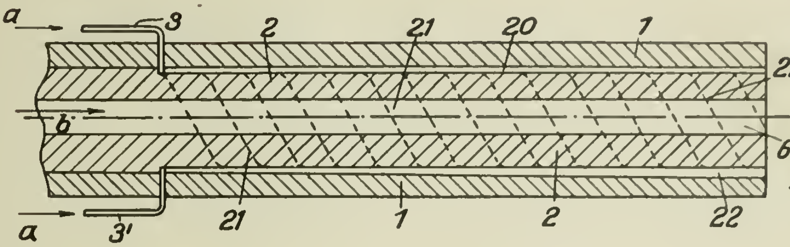

Fig. 1
Fig. 2

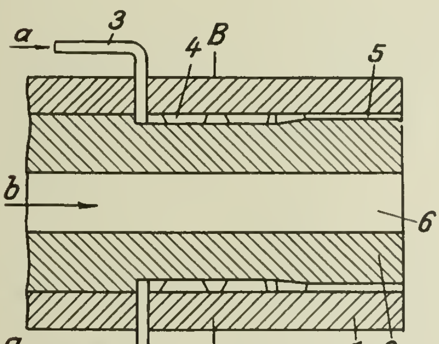

Fig. 3

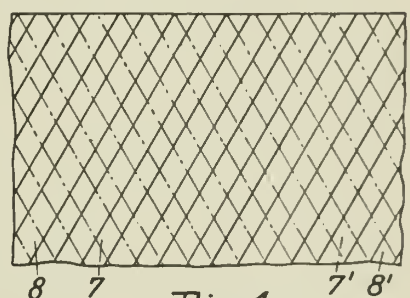

Fig. 4

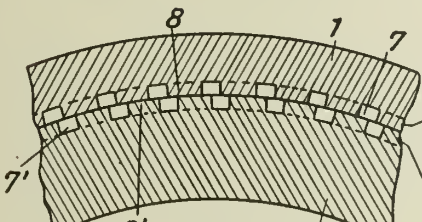

Fig. 5

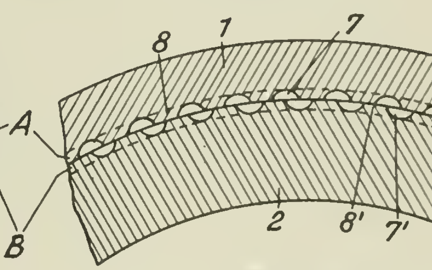

Fig. 6

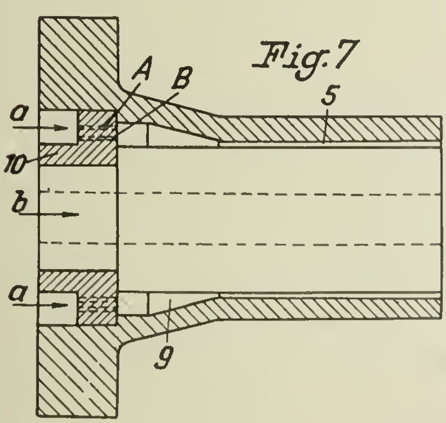

Fig. 7

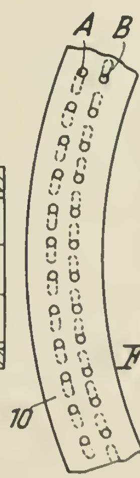

Fig. 8

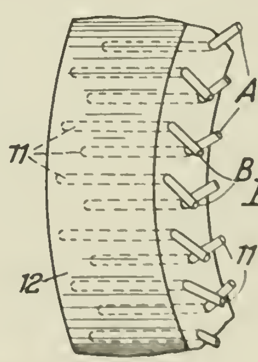

Fig. 9

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PUBLISHED

APRIL 27, 1943.

BY A. P. C.

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PROCESS AND APPARATUS FOR THE MANUFACTURE OF ARTIFICIAL SAUSAGE SKINS

Filed May 9, 1938

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Fig. 10

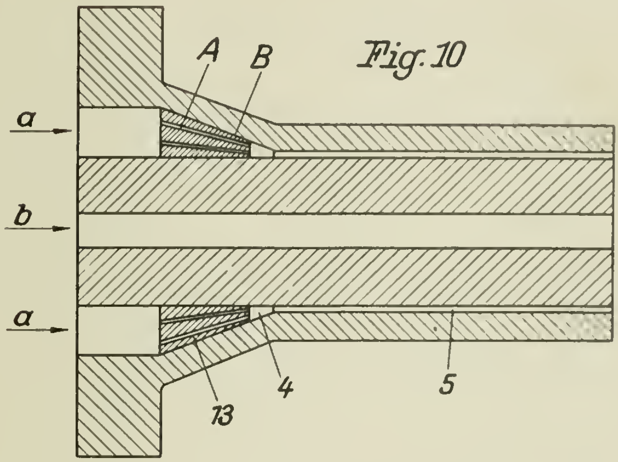


Fig. 11

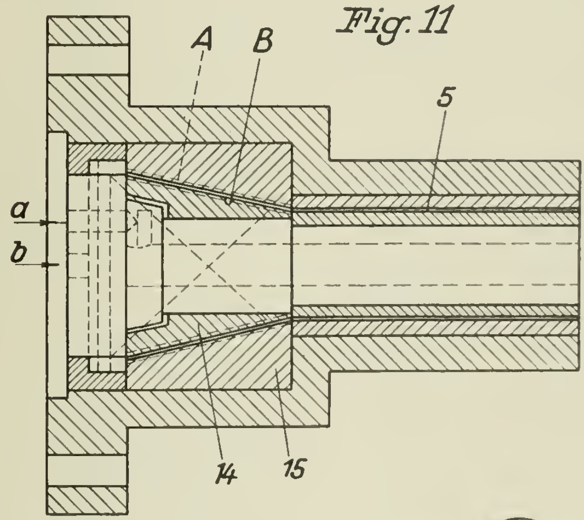
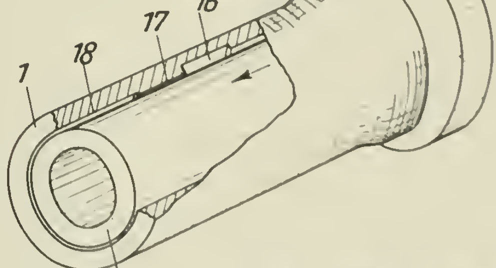


Fig. 12



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PUBLISHED

APRIL 27, 1943.

BY A. P. C.

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PROCESS AND APPARATUS FOR THE MANUFACTURE OF ARTIFICIAL SAUSAGE SKINS

Filed May 9, 1938

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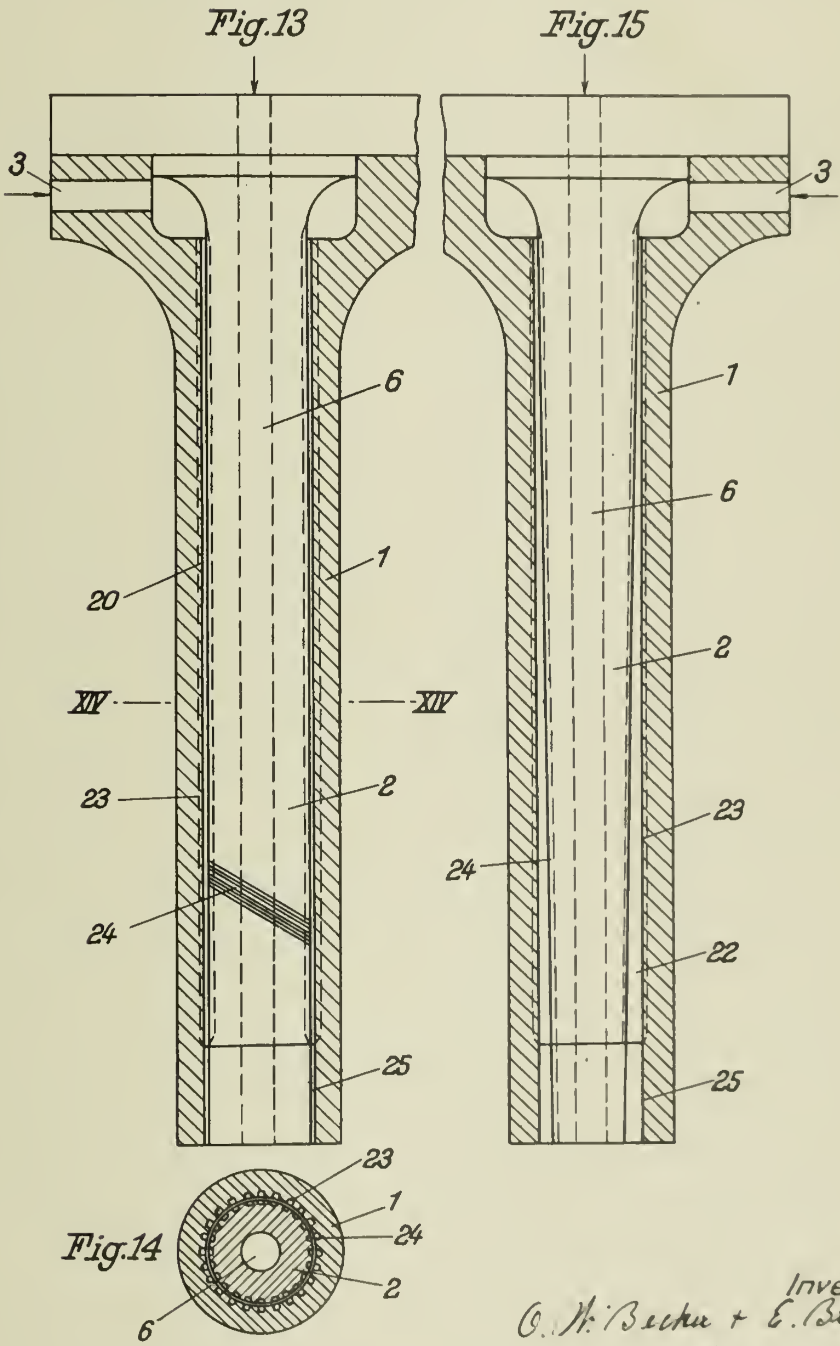

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Published Apr. 27, 1943

Serial No. 209,150

ALIEN PROPERTY CUSTODIAN

GLASS-TO-METAL SEALS

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No Drawing. Application filed May 20, 1938

It is known that in the fusing between metal and glass, the condition of the surface of the metal portion exerts an essential influence on the rigidity of the connection between the metal and the glass. It is also known that a surface oxidation of the metal portion is very essential for the adhesion of the glass. The present invention is a method for producing fusions between glass and metal by which easily reproducible requirements for the adhesion of the glass is afforded. According to the invention, the metal part is covered by a thin layer of glass containing an adhesion oxide at least at the fusing position before carrying out the actual fusing; the layer of glass has the same expansion coefficient as the fusing glass itself. Naturally, the thin layer may be constructed of the fusing glass inself.

For the purpose of covering the metal part at least at the fusing position with a thin glass layer containing oxide, we proceed by depositing on the positions to be covered with a glass layer, glass powder, preferably in the form of a plastic mass. For this purpose, a suitable glass, for example, a fusing glass, of which it is known that it gives, with the metal under consideration, a vacuum-tight connection, is pulverized and set with the adhesion oxide. If, for example, the production of a connection between iron, nickel or chromium containing metals or alloys and glass is involved, 5% cobalt oxide and 1% nickel oxide is added to the glass powder for example.

To obtain from the glass powder and the added adhering oxide, a plastic mass, it is desirable to use protective colloids. For example, the above-named glass powder may be set with 6% clay and approximately 1% soda and stirred in a plastic mass with water. This mass is deposited on the glass portion to be fused, and preferably while on the fusing position, dried and then fused into a glassy coating. If not only the fusing position is covered with such a coating, but also the zones surrounding the actual fusing position to an extent of one or several centimeters, an insulating coating is at the same time obtained which prevents the deposit of undesired discharge on the metal portions. This applies as well for fuse-in bars or wires, as, for example, parts which surround a particular plug-type glass portion (plug fusing).

After the production of a glass coating, the fusing process is carried out in the usual manner. If the so-called plug fusings are involved, for example, the metal ring of the plug fusing is first provided with a glass coating; then the fusing bar or wire is fastened within the metal ring and the space between the metal ring and the fusing wire is filled with glass. The glass part is then preferably fused in an electric furnace, under certain circumstances, in the presence of oxygen. Also, the fusing bar or wire may, before carrying out of the actual fusing process, be covered in the described manner with a glass layer.

The method, according to the invention, has the advantage that we may start with metal parts that are oxidized in well defined manner. By the covering of the metal parts with a mass that may be put on by stroking, and which by heating is converted into a glassy coating, the essential variation of the condition of the surface of the metal part to be fused is prevented. This has, as a consequence, that under the glass coating at all points, a base is present which avails an intimate connection between glass and metal. For this reason, difficulties are avoided in the construction of the final fusing which, under certain circumstances, may arise by reason of the fact that even before the metal part is covered with glass, oxidation or reduction processes take place which may injure the connection between the glass and the metal.

For the production of fusings of glass with metals, such as molybdenum, are cobalt nickel and iron containing alloys with a cobalt content of approximately 20%, a nickel content of 30% and an iron content of approximately 50%, hard glass comes into consideration which has an expansion coefficient of approximately 50×10^{-7}. The glass on the metal part, in accordance with the invention, is constructed of a glass which has the same expansion coefficient, or which deviates by a small amount. Preferably, the coating is constructed of the same glass which is used for the construction of the other parts of the fusing. For the fusing of glass with chromium iron or nickel iron alloys, platinum EMK and the like, soft glass must, on the other hand, be utilized, and it has an expansion coefficient of 100×10^{-7} In this case also, such glass is used for producing the glass coating.

The method, according to the invention, may naturally also be used when glass with iron or nickel parts which contain no essential addition of other metals are to be fused. In this case, provision must be made by properly forming the metal and glass parts that no considerable tensional stresses be set up after the cooling of the fusing in the glass part. In such a case, we may operate with glass, the expansion coefficient of which deviates appreciably, for example, by 30° from the expansion coefficients of the metal parts. Also in these cases may the fusing process be essentially facilitated by using the method according to the invention.

It is essential for the invention that the glass coating on the metal part be free from components which, under certain circumstances, when being heated, give up gas, or may be decomposed. Such components are contained in the usual enamels in the form of flux means or turbidity means.

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Published Apr. 27, 1943 Serial No. 217,505

ALIEN PROPERTY CUSTODIAN

APPARATUS FOR GAS TURBINES

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Application filed July 5, 1938

In gas turbines, where the working medium is being compressed to a pressure higher than the admission pressure of the compressor, the efficiency of the compressor plays a very essential and in fact decisive part, seeing that the work supplied by the equipment really consists in the difference as between the work transmitted by the turbine to the shaft and the work absorbed from the shaft by the compressor. Particularly suitable for enabling high efficiency to be achieved are the compressors of the type in which the mean diameter of any stationary or rotating blade ring is at least approximately equal to the average of the mean diameters of the two adjacent blade rings and in which the blades have a cross-section resembling the profiles of aeroplane wings as usual in aerodynamical practice, or a thin sheet-like cross-section. Compressors of such a type are operating at a high efficiency as long as the velocity of the working medium relatively to the blades does not approximate the velocity of the propagation of sound vibrations in the working medium. For this reason it is advisable to fix the upper limit of the velocity of the working medium relatively to the blades at 0.6–0.7 times the figure of the velocity of propagation of sound vibrations. In view of the fact that the velocity of propagation of sound vibrations in air amounts at a temperature of 15° C to about 330 m/sec, the relative velocity in question should preferably not exceed 230 m/sec. If hereto it is added that, on the other hand, in view of obtaining a high efficiency the meridian velocity of the medium (its velocity of throughflow in the axial section) should preferably be assumed at 0.3 to 0.8 times the peripheral velocity, there will result the disadvantageous situation that if the relative velocity of 230 m/sec mentioned is adhered to, it would not be possible for the peripheral speed to exceed 185 m/sec. On the other hand in order that such compressors whilst keeping their weight and dimensions low, should be able to supply an as large output of work as possible, i. e. a sufficiently high pressure, it is essential that the peripheral speed of the blade rings should be as high as possible and should approximate the figure which is still permissible from the point of view of mechanical resistance in the blades or in the rotor carrying the blades. For this reason the equipment will in case of the low peripheral speed mentioned above become, for many cases of employment, too heavy and too expensive.

Owing to the limitation prescribed regarding the relative velocity, a disadvantageous position will result also owing to the fact as in the turbine it is in any case possible to permit a larger relative velocity than in the compressor and thus if the compressor is direct-coupled with the turbine it would only be possible for it to be of smaller diameter than the turbine. In the case of such a type of design, however, the compressor will not be able to draw-in and supply the necessary quantity of gas. Accordingly, in this case, if in accordance with the proposals as made up to now it is desired to utilise in a full extent in the turbine as well as in the compressor the peripheral velocities of permissible magnitude, it would be necessary for the compressor and for the turbine to run at different members of revolutions per minute, which would necessitate an expensive and complicated transmission gear.

The apparatus according to the invention climinates these drawbacks in such a manner, that it diminishes the relative velocity between the blades and the working medium in the compressor, by setting the working medium into rotation, in the sense of rotation of the compressor rotor. The working medium rotates in the compressor in the direction of rotation at least on one diameter of the blades at a velocity amounting on the average approximately to one-half the peripheral velocity of the rotor, it is, however, also possible for the velocity of rotation, to deviate therefrom so as to possess a higher or a lower figure than the one defined above. If the average peripheral velocity of the working medium is sufficiently high relatively to the peripheral velocity of the rotor e. g. if it amounts to at least ¼ of the latter, a substantial diminution of the relative velocity will already be obtained. On the other hand if the velocity of rotation of the medium is greater than ¾ of the peripheral velocity of the rotor, it is relatively to the stationary blades that the relative velocity will be high. For this reason it is necessary that the average velocity of rotation, at least on one diameter of the blades, should remain between ¼ and ¾ of the peripheral velocity of the rotor. Thus a much higher peripheral velocity than the one permissible up to now can be permitted in the rotor, in consequence whereof, on the one hand, the efficiency of the compressor will not deteriorate, whilst on the other hand its capacity of performance will be increased or with a given capacity of performance it will be possible to reduce its dimensions and direct coupling of the compressor with the turbine will become possible. The average rotation at a considerable velocity of the working medium in the compressor is obtained by the suitable adjustment of the blading.

In case the average rotation of the working medium is equal to one-half the peripheral velocity of the rotor, the relative velocities relatively to the rotating and to the stationary blades will be approximately equal.

In case the turbine likewise is fitted with bladings possessing a cross-section resembling the aeroplane wing profiles usually employed in aerodynamical practice, and in case the mean diameter of any stationary or rotating blade ring of the turbine is at least approximately equal to the average of the mean diameters of the two adjacent blade rings, it is possible to obtain a more advantageous efficiency in the turbine also, if the relative velocity as between the working medium and the blades is kept below the figure of the velocity of the propagation of sound vibrations. The velocity of the propagation of sound vibrations in the turbine is in general higher than in the compressor, owing to the fact that the temperature of the working medium is also higher. On the other hand the higher temperature of the working medium will increase the volume of the latter also and thus it will usually be necessary to permit higher throughflow velocities in the turbine, whereby the relative velocity as between the working medium and the blades will be increased. For this reason it will, in view of not approximating the velocity of propagation of sound vibrations too closely, be advantageous to set the working medium into substantial rotation in the direction of the peripheral velocity of the rotor in the turbine also, preferably in such a manner that the working medium should at least on one diameter of the blades circulate at approximately, on the average, one-half the peripheral speed of the blades, which aim can likewise be assured by the suitable adjustment of the blading.

In order to enable the invention to be more readily understood, Fig. 1 shows the diagrammatical section of a compressor and turbine direct-coupled or built integral. Fig. 2 is a development into a plane of a section taken through the blades of the compressor. Fig. 3 represents the velocity triangles relating to the stationary and rotating blades of the compressor, Fig. 4 is a development into a plane of a section taken through the blades of the turbine, whilst Fig. 5 shows the velocity triangles relating to the stationary and rotating blades of the turbine.

On Fig. 1 the rotor **6** keyed on the shaft **5** journalled in the bearings **3** and **4** is arranged in the compressor or turbine casing **1**; this rotor carries on the one hand the rotating compressor blades **7** and on the other hand the rotating turbine blades **8**. It is into the compressor casing **1** that the stationary compressor blades **9** are mounted whilst the stationary turbine blades **10** are mounted into the turbine casing **2**. In the embodiment shown by way of example the high pressure space **11** of the compressor is closed off from the admission space **12** of the turbine by the labyrinth packing **13**. On the discharge end of the turbine the shaft is rendered tight by means of the labyrinth packing **14**. The work obtained can be taken off on the shaft **15**. The method of operation of this apparatus is the following:

The working medium enters the compressor through the inlet duct **16** and leaves the compression space **11** in a compressed condition through the duct **17**. Heat is introduced by means of the combustion of fuel in a manner and with the aid of apparatus not shown on the drawing into the working medium discharged through the duct **17**, following which the working medium thus heated is led through the inlet duct **18** into the turbine in which it expands, performs work and finally leaves the turbine through the duct **19**.

It is also possible—according to known proposals—to effect, before the introduction of the heat of the fuel, the pre-heating, in a suitable heat exchange device, by means of the heat of the spent gases leaving the turbine, of the compressed working medium discharged through the duct **17**. According to other proposals it is also possible to introduce the heat of the fuel during the passage of the working medium through the turbine, or, entirely or partly even after the working medium has performed its throughflow through the turbine, and in this latter case to make provision for the heat generated being transferred to the fresh quantity of working medium by means of a heat exchange device.

On Fig. 2 the moving compressor blade rings **20** and **21** are rotating with the peripheral velocity u in the direction of the arrow I, whereas the stationary blade rings **22** and **23** are immovable. The base line of the moving blade profiles (which is approximately identical with the aerodynamically neutral direction, i. e. with the direction defined by the fact that a current of air attacking in this direction will not cause any force of buoyancy on the blade) forms with the peripheral direction, at the point of leaving the blade ring, the angle β_2, whilst the base line of the stationary blades is, at the point of leaving the blade ring likewise, forming with the peripheral direction the angle β_1.

In the velocity diagrams shown on Fig. 3, v_a denotes the throughflow (meridian) velocity of the working medium when flowing through the compressor, u denotes the peripheral velocity of the rotor, whilst v_t denotes the mean velocity in the peripheral direction of the working medium. Into any stationary blade ring the working medium enters with the absolute velocity c_1 and leaves it with the absolute velocity c_2. The mean value c_k of the two velocities represents the mean absolute velocity of the working medium. The component in the peripheral direction of this last named velocity is v_t, the average figure of which, taken at least on one diameter of the blade, is preferably approximately equal to one half the peripheral velocity, but may also be greater or smaller than this figure (what is important from the point of view of the invention being that the average peripheral velocity of the medium should be sufficiently high relatively to the peripheral velocity of the rotor). The relative inlet velocity relatively to the rotating blades is obtained by adding-up the outlet velocity relatively to the stationary blades and the velocity u. The velocity thus obtained is c_1'; the relative outlet velocity is c_2', whilst the relative mean velocity is c_k'.

The aerodynamically neutral direction of the blades is, as has been mentioned, the direction defined by the fact that in case of a relative flow in this direction the blade force perpendicular to the direction of the flow is zero, and accordingly this direction is approximately identical with the direction of the tangent on the compressed (concave) side of the blade profile, i. e. with the direction of the base line of the blade profile. The angle formed by the direction defined in this manner and by the peripheral direction is according to Fig. 3 also in the case of the stationary blades β_1, and in the case of rotary blades β_2.

In order to ensure that the relative velocity as between the working medium and the blades should be as small as possible, the mean velocity of rotation of the medium should preferably be made equal to one-half of the peripheral velocity. This condition is approximately satisfied in that case when the angles formed by the peripheral direction with the base lines of the profiles of the stationary and of the rotary blades are, at least on one diameter of the blades, approximately mutually identical.

In the case of the turbine blades shown on Fig. 4 the moving blade rings **24** and **25** are rotating in the direction of the arrow II with the peripheral velocity u and the base lines of their blade profiles (representing approximately the aerodynamically neutral direction) are at the point of inlet into the blade ring forming with the peripheral direction the angle β_4, whilst the base lines of the blade profiles of the stationary blade rings **26** and **27** are at the point of inlet into the blade ring likewise forming with the peripheral direction the angle β_3.

In the velocity triangles shown on Fig. 5 the denotations are, suitably interpreted, identical with the denotations shown on Fig. 3. With a given peripheral and given meridian velocity the lowest relative velocity between the blades and the working medium is obtained in case the average velocity of rotation of the working medium is, at least on one diameter of the blades, approximately equal to one-half the peripheral velocity of the rotor. This can be assured if the blade angles are adjusted in such a manner that the base lines (i. e. the aerodynamically neutral directions) of the profiles of the stationary and of the moving blades should, at least on one diameter of each of these two kinds of blade rings, form approximately equal angles with the peripheral direction.

In view of the fact the temperature of the working medium varies in the compressor as well as in the turbine, it is not necessary that the condition of the lowest relative velocity should be fulfilled in each stage. A very large advantage is obtained already in case a substantial average rotation is given to the working medium in the direction of the peripheral velocity of the rotor. This can be achieved in the case of the compressor, as well as in the case of the turbine, by deflecting the base line of the stationary blades from the meridian plane, in the direction—viewed in the direction of the flow—of the peripheral velocity of the rotor.

The constructional condition for the average velocity of rotation of the medium being situated between ¼ and ¾ of the peripheral velocity of the rotor consists in that the value of the fraction composed of the tangent of the angle β_1 formed by the base line of the stationary blades with the peripheral direction as of a numerator and of the tangent of the angle β_2 formed by the base line of the rotating blades with the peripheral direction, as denominator, should at least on one blade diameter be situated between ⅓ and 3.

Instead of the form of construction shown on the drawing and described in the specification by way of example it is possible to employ a great many other kinds of constructional forms also, whereby the substance of the apparatus according to the invention and the range of protection of the invention are not modified in any way. Thus the compressor or the turbine may, for instance, also be arranged for radial throughflow, or throughflow may also take place along a cone surface, or in general around a rotational surface. From an aerodynamical point of view it is advantageous if the average velocity of rotation of the working medium stands in inverse proportion to the distance from the axis of rotation. This can be ensured by the suitable torsional deflection of the blades. The blades may also, as mentioned in the introductory part of this specification, be of thin sheet-like shape, which shape can be considered to represent the "limit" case of aerodynamical profiles.

Finally, it is worth mentioning that the invention modified in a logically corresponding manner, can also be employed on gas turbine equipments, in which the compressor or the gas turbine proper or both of these two main parts now mentioned are designed in such a manner that in addition to the rotor, the so-called "stator" is also made rotatable in a sense of rotation opposite to that of the rotor. If the peripheral velocity in any blade ring of the "stator" is denoted at a certain blade diameter by u_1, whilst in the adjacent blade ring of the rotor cooperating with the said blade ring of the "stator" the peripheral velocity is denoted by u_2, u_1 being $\leqq u_2$, it is the difference of velocities u_2-u_1 which will represent the figure of velocity which is decisive regarding the peripheral velocity in the direction of rotation of the rotor of the working medium flowing in the compressor, so that it will not be possible in the cases according to the invention for the peripheral velocity of the working medium to be lower than ¼ of this velocity or to be greater than ¾ of this velocity. Employing the same denotations it is possible to indicate regarding the angles β_1 and β_2 of the stationary and rotating blades of the compressor and the turbine the following mathematical relation according to the invention:

$$\frac{1-\frac{u_1}{u_2}}{4}<\frac{1-\frac{u_1}{u_2}\cdot\frac{tg\beta_1}{tg\beta_2}}{1+\frac{tg\beta_1}{tg\beta_2}}<\frac{3}{4}\left(1-\frac{u_1}{u_2}\right)$$

which relation will in case of $u_1=0$ (i.e. in case of the compressor or turbine casing being stationary) become converted into the condition:

$$\frac{1}{3}<\frac{tg\beta_1}{tg\beta_2}<3$$

already referred to above.

In case of blade rings rotating in mutually opposite directions the arrangement will be practically the most advantageous for the compressor if $u_1=u_2$, as in such a case the working medium will only rotate relatively to the rotor and to the casing of the compressor, but will not rotate actually.

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PUBLISHED
APRIL 27, 1943.
BY A. P. C.

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APPARATUS FOR GAS TURBINES
Filed July 5, 1938

Serial No.
217,505
2 Sheets-Sheet 1

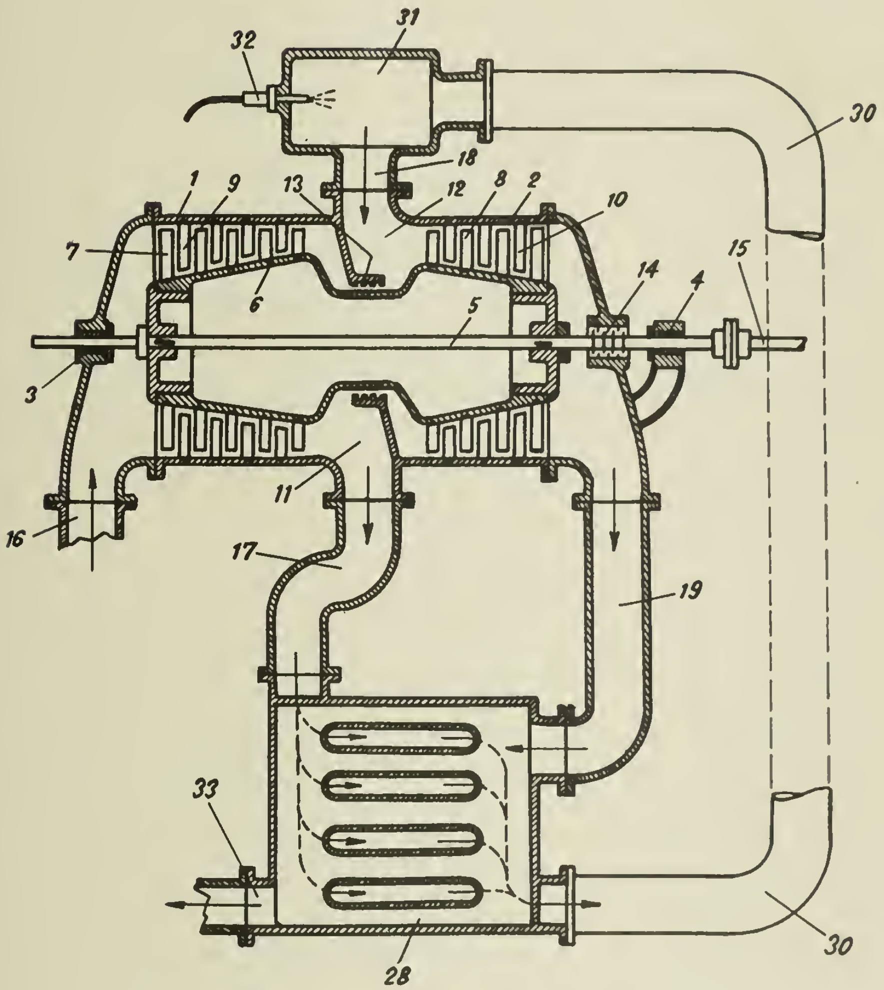

Fig. 1.

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PUBLISHED
APRIL 27, 1943.
BY A. P. C.

G. JENDRASSIK
APPARATUS FOR GAS TURBINES
Filed July 5, 1938

Serial No.
217,505
2 Sheets–Sheet 2

Fig. 2.

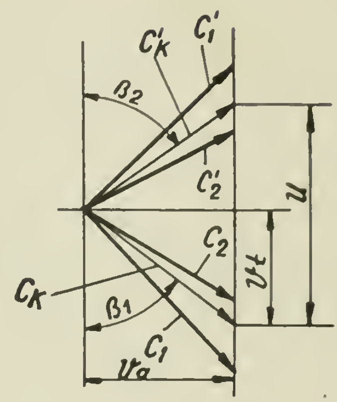

Fig. 3.

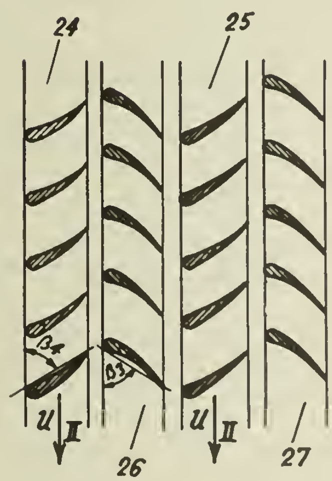

Fig. 4.

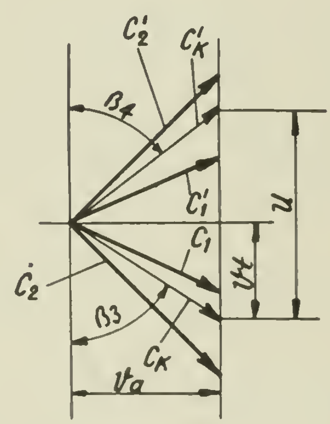

Fig. 5.

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Published Apr. 27, 1943

Serial No. 215,792

ALIEN PROPERTY CUSTODIAN

AIRCRAFT ENGINES

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Application filed June 25, 1938

Our invention relates to the propulsion of aircraft and more especially flying machines. It has particular reference to the utilization of the energy of the exhaust gases of the propelling engines for the propulsion of the craft.

It is an object of our invention to provide means whereby the energy of the exhaust gases can be utilized for the purpose in view.

We are aware that it has already been suggested to utilize the energy of the exhaust gases of aircraft engines directly by utilizing the reaction effect arising during the exhaust into the ambient air. Either the exhaust gases issuing from the cylinders of the engine have been shoved into a collecting chamber and allowed to escape from this chamber in a direction counter to the direction of flight (jet drive with constant outflow). Alternatively the gases escaping from each cylinder individually have been allowed to escape rearwardly, i. e. counter to the direction of flight (jet drive with intermittent outflow).

It has now been found that this latter mode of utilization of the exhaust gases, while being superior to that mentioned in the first place, is still very imperfect since with the exhaust valves customarily used a comparatively great part of the energy of these gases is annihilated by vortex generation. In order to keep these losses low it has already been suggested to use exhaust valves of nozzle-shape, however such valves cannot always be used, since they require a great overall height of the cylinder heads, which is undesirable from the viewpoint of keeping the air resistance low. But even in those cases, where this drawback would not play a decisive role, it is practically impossible to altogether avoid annihilation of exhaust energy by using nozzle-shaped exhaust valves.

According to this invention means are provided for utilizing the energy of the exhaust gases, in which the exhaust gases are made to escape from the individual cylinders in such manner that with cylinder outlets formed in the usual manner a satisfactory efficiency is obtained and the degree of utilization of the exhaust energy, which can practically be attained with engines fitted with nozzle-shaped valves is still improved. We obtain this by providing at the outlet of the exhaust conduit adjoining the exhaust port of the engine cylinder, a nozzle which is so organized that on the gases of combustion passing from the cylinder into the exhaust gas conduit a short rise of pressure and in consequence thereof an increase of the exhaust velocity of the gases in the nozzle and consequently also an increase of the reaction force are obtained.

Our invention further relates to a satisfactory construction of such exhaust device in connection with internal combustion engines having a row of cylinders.

In the drawings affixed to this specification and forming part thereof several embodiments of our invention are illustrated diagrammatically by way of example.

In the drawings

Fig. 1 is an axial section of the cylinder head and the adjoining part of the cylinder of a propeller engine fitted with a device according to this invention.

Fig. 2 is a diagram illustrating the dependency of the engine performance from the ratio of tapering of the exhaust nozzle in a device according to Fig. 1.

Fig. 3 is a diagrammatic axial section of a device similar to that shown in Fig. 1, while

Fig. 3*a* is a diagram illustrating the run of the exhaust pressure in a device according to Fig. 3.

Fig. 4 is an axial section of another form of nozzle adapted for use in connection with the cylinder of Fig. 1, and

Fig. 5 is a similar view of another nozzle.

Fig. 5*a* illustrating the run of the exhaust pressure arising in the operation of the device of Fig. 5.

Fig. 6 illustrates still another form of a nozzle.

Figs. 7 and 8 are a front elevation and plan view of an internal combustion engine with two rows of cylinders arranged V-fashion and provided with a device according to this invention for utilizing the energy of the exhaust gases.

Fig. 9 is a plan view of a modified form of this engine.

Referring to the drawings and first to Fig. 1. **1** is the cylinder of an internal combustion engine in which the piston **3** is arranged for reciprocation under the action of the connecting rod **4** linked to the crank shaft (not shown). The cylinder is closed by the cylinder cover **2**, in which is arranged an exhaust valve **6** controlled in any well known manner. The exhaust conduit **7** on the other side of the valve is so formed that its outlet is directed counter to the direction of flight indicated by the arrow *a*. On the conduit **7** is mounted a nozzle **8** which is formed at the inlet with the same cross-sectional area f_A as the conduit **7** and tapers constantly towards the outlet.

The action of this device is the following: After the outlet valve **6** has opened, the gases

of combustion flow from the combustion zone 5 into the exhaust conduit 7. By means of the nozzle 8 adjoining the conduit 7 the flow of the gases of combustion from the conduit 7 into the atmosphere is throttled and a rise of pressure in the conduit 7 is effected. While this rise of pressure to a certain extent brakes the passage of the exhaust gases from the cylinder into the conduit 7 and in consequence thereof diminishes the performance available at the crank shaft of the engine, it also increases the velocity of the exhaust gases at the end of the nozzle and consequently also the reaction force.

The magnitude of the outflow velocity of the exhaust gases at the end of the nozzle and the magnitude of the reaction force depends, in a device according to Fig. 1, from the tapering ratio of the nozzle, i. e. from the value

$$\frac{f_D}{f_A}$$

of the cross-sectional areas f_D of the narrowest part of the nozzle at its end and the cross-sectional area f_A at the nozzle inlet.

In Fig. 2 the dependency of the propulsion performance of an engine provided with a device according to Fig. 1 from the tapering ratio

$$\frac{f_D}{f_A}$$

is illustrated in a diagrammatical manner with reference to a predetermined speed of flight. In this diagram the values of the tapering ratio

$$\frac{f_D}{f_A}$$

are plotted as abscissae and the performance M as ordinate. The curve I indicates the performance N_m available at the crank shaft of the engine, the curve II the reaction performance N_r. Curve III illustrates the total performance N, i. e. the sum of N_m+N_r. Fig. 2 shows that the crank shaft performance N_m becomes the smaller, the smaller the value

$$\frac{f_D}{f_A}$$

As mentioned above this is due to the throttling of the waste gas exhaust from the cylinder. In contrast thereto the reaction performance N_r rises in proportion as the tapering ratio

$$\frac{f_D}{f_A}$$

drops; in the case illustrated in Fig. 2 the rise of N_r occurs more quickly in the range between

$$\frac{f_D}{f_A}=1$$

and

$$\frac{f_D}{f_A}=0.6$$

than the dropping of N_m in the same range. In consequence therefrom the total performance $N=N_m+N_r$ rises in proportion as

$$\frac{f_D}{f_A}$$

drops, until it has reached a maximum about at the value

$$\frac{f_D}{f_A}=0.6$$

Therefore in a device according to Fig. 1 it is preferable to use a nozzle, the tapering ratio of which lies between 0.3 and 1.

It has further been found that the total performance available, when using a device according to Fig. 1, depends further in a similar manner from the value of the ratio

$$\frac{V_s}{V_z}$$

of the volume V_s of the conduit 7 to the stroke volume V_z of the engine cylinder. In the case of a device according to Fig. 1 it is advantageous to so dimension the conduit 7 that its volume ranges between about 0.3 and 1, calculated on the stroke volume.

The form of the nozzle according to claim 1 is more especially correct in the case where the outer pressure, i. e. the pressure in the space into which the exhaust gases escape (the atmosphere) is higher during the greater part of the exhaust period, than the critical pressure determined by the pressure and that velocity in the conduit 7, at which sound velocity is attained.

Fig. 3 is a diagram according to Fig. 1, while Fig. 3*a* is a diagram illustrating the course of pressure in such a device shortly after the outflow has begun, i. e. at high pressure in the working cylinder. 15 is the working cylinder of an internal combustion engine, 16 the cylinder outlet, 17 is the exhaust conduit adjoining this outlet and 18 the nozzle fixed to the exhaust end of the conduit. In the cylinder 15 prevails the pressure p_1 (Fig. 3*a*). When the cylinder outlets 16 are opened, the gases in the cylinder escape and the pressure p_1 drops within the range of the outlets 16 to p_k (critical pressure) which is reached in the narrow cross-sectional area. If the cross-sectional area of passage in front of the narrowest cross-sectional area gradually increases up to the value f_A, which is the cross-sectional area of the conduit 17, the pressure drops from p_k to p_i (inner pressure in the conduit 17), which remains approximately constant in this conduit. In the nozzle 18 the pressure p_i then drops further until it reaches the outer pressure p_2 which is higher than the critical pressure p_{ik} correlated to the pressure p_i and the gas velocity in the conduit. If during the greater part of the exhaust period the outer pressure is lower than the critical pressure determined by the pressure and gas velocity in the conduit 7, at which sound velocity is reached, and the speed at which the exhaust gases pass through conduit 7 (according to Fig. 1), below the critical value, the nozzle 8 in Fig. 1 or 18 in Fig. 3 is preferably replaced by a nozzle 20 according to Fig. 4. This nozzle uniformly tapers, viewed in the direction of flow (part 21) in such manner that its cross-sectional area at the inlet which is equal to the cross-sectional area f_A of the conduit 7, gradually drops to the value f_D at the point C. The part 22 of the nozzle 20 which extends in front of the point C, flares gradually in the direction of flow.

A diagram illustrating a device provided with a nozzle of this kind is shown in Fig. 5, while Fig. 5*a* shows the course of pressure shortly after the outlets have been opened and while the pressure in the cylinder is still high. This course of pressure up to the nozzle is similar to that according to Fig. 3*a*. In the nozzle the gases are then expanded to the outer pressure p_2, the critical pressure p_{ik} prevailing at the narrowest point C. If, during a material part of the exhaust period, the speed at which the exhaust gases in the conduit 7 or 17 flow towards the nozzle, is equal to or greater than the critical speed, the same conditions prevail as at the narrowest part C of nozzle 20 in the example of Fig. 5; consequently in this

case a nozzle **25** according to Fig. 6 is attached to the conduit **7** or **17**, which nozzle, viewed in the direction of flow, is merely formed with a constant flaring.

Figs. 7 and 8 are an end view and plan view, respectively, of an aircraft engine with two rows of cylinders arranged V-fashion and provided with a device of the kind above described. The exhaust tubes **34***a*—**34***f* and **35***a*—**35***f*, respectively, fitted to the exhaust ports of the working cylinders **30***a*—**30***f* and **31***a*—**31***f*, respectively, which carry at their ends exhaust nozzles **32***a*—**32***f* and **33***a*—**33***f*, respectively, are so curved that the exhaust of the gases into the atmosphere occurs counter to the direction of flight (arrow *b*). They have the form of hollow bodies with cross-sectional areas of passage uniform or approximately uniform throughout their length, the circular cross-section at the inlet of the tube gradually merging into a strongly flattened cross-section near the end of the tube. The nozzles are flattened also in a similar manner and the flattened portions of the tubes are arranged in substantially parallelly spaced relation, the exhaust ends of the nozzles being arranged in staggered relation. We thereby obtain a small length of the tubes transversely to the direction of flight, which is desirable in the interest of a low air resistance.

Fig. 9 illustrates a particularly favorable form of an engine similar to that shown in Fig. 8, where the exhaust tubes **36***a*—**36***f* and **37***a*—**37***f*, respectively, are so curved, that the direction, in which the exhaust gases escape (arrow C in Fig. 9) encloses an acute angle α with the direction of flight (arrow *d*). It is true that in this arrangement only that component of the reaction force, which coincides with the direction of flight, is utilized for propulsion, however with a small angle α, this component is only little less than the total reaction force and the loss is therefore only insignificant. At the same time however we thus obtain the advantage that, viewed in the direction of flight, the outflow ends of the nozzles can be arranged one behind the other, so that in view of the further reduction of the length of the tube transversely to the direction of flight the air resistance is reduced still further.

In the arrangements according to Figs. 7–9, it is preferable, in order to further reduce the air resistance, to provide a streamlined envelope (**40** in Fig. 9), which must be formed with longitudinal slits **41** for the passage of the exhaust gases. In order to avoid unduly high temperatures at the exhaust tubes and nozzles, an aperture **42** for the entrance of cooling air is provided at the front end of the envelope. This air, after having taken up heat from the hot exhaust tubes and nozzles, escapes through the slits **41** together with the exhaust gases.

We wish it to be understood that we do not desire to be limited to the exact details of construction shown and described for obvious modifications will occur to a person skilled in the art.

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PUBLISHED
APRIL 27, 1943.
BY A. P. C.

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AIRCRAFT ENGINES
Filed June 25, 1938

Serial No.
215,792
4 Sheets-Sheet 1

Fig.1

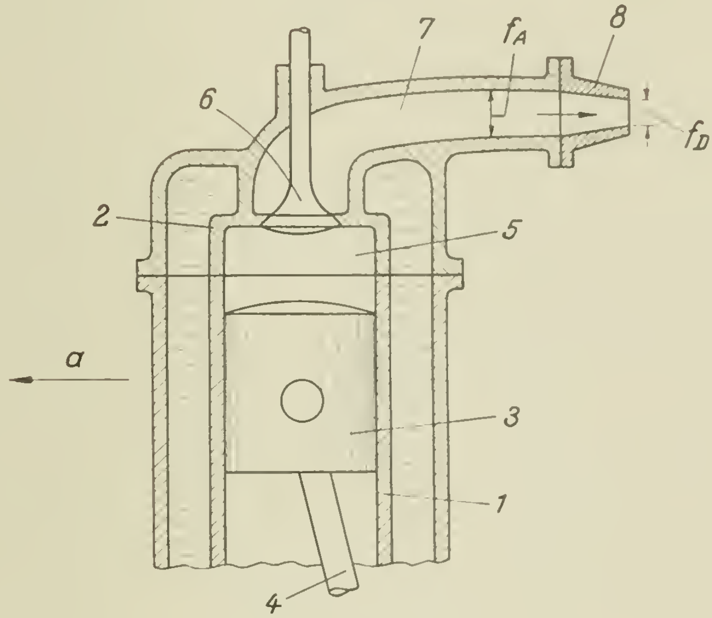


Fig.4

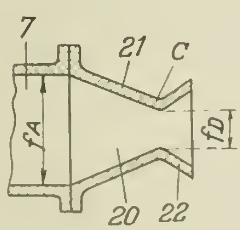
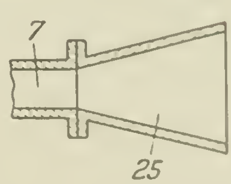


Fig.6



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PUBLISHED	F. NEUGEBAUER ET AL	Serial No.
APRIL 27, 1943.	AIRCRAFT ENGINES	215,792
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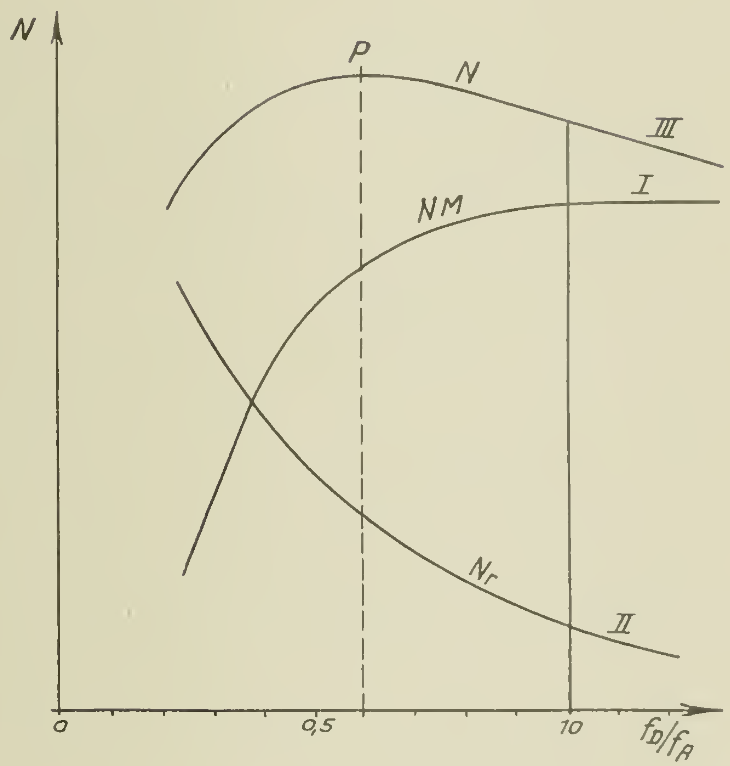
Fig. 2



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PUBLISHED
APRIL 27, 1943.
BY A. P. C.

F. NEUGEBAUER ET AL

AIRCRAFT ENGINES

Filed June 25, 1938

Serial No.
215,792

Fig. 3

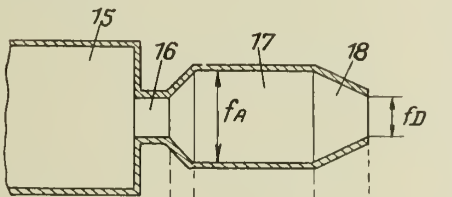


Fig. 3a

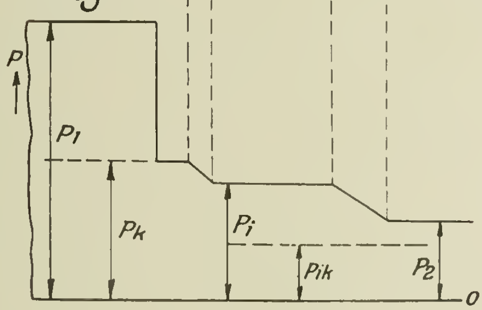


Fig. 5

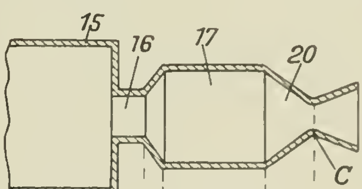
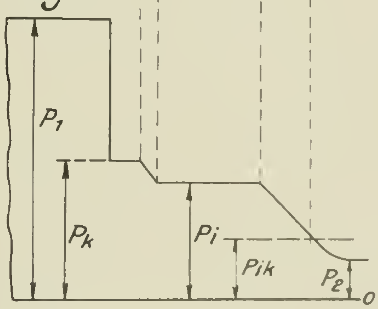


Fig. 5a



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APRIL 27, 1943.	AIRCRAFT ENGINES	215,792
BY A. P. C.	Filed June 25, 1938	4 Sheets–Sheet 4

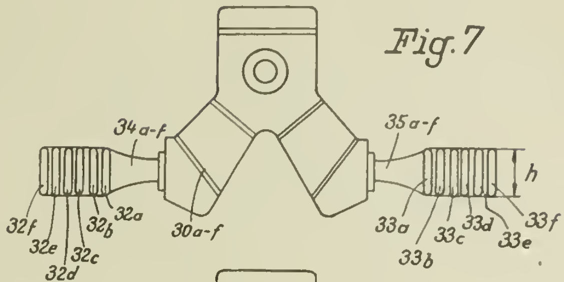

Fig. 7

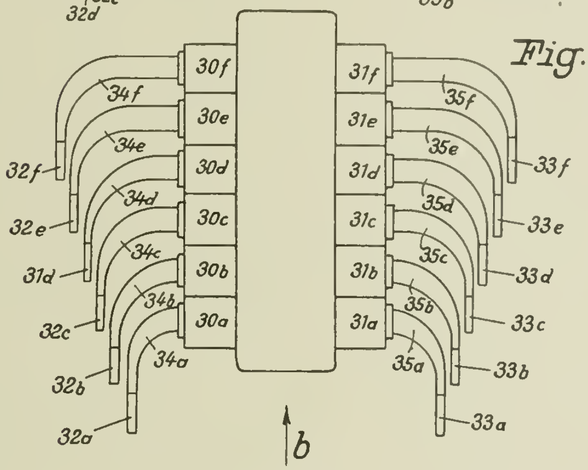

Fig. 8

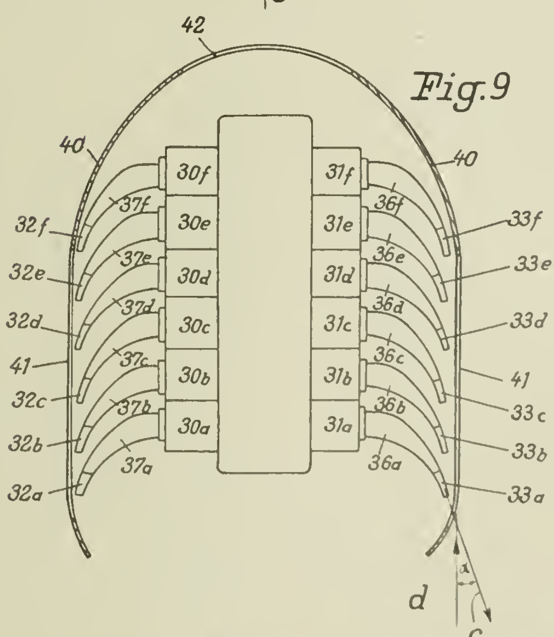

Fig. 9

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Published Apr. 27, 1943

Serial No. 221,022

ALIEN PROPERTY CUSTODIAN

FINISHING

Kurt Quehl, Zwickau, Germany; vested in the Alien Property Custodian

No Drawing. Application filed July 23, 1938

This invention relates to a process of producing finishing effects unaffected by washing, particularly in textiles like woven or knit fabrics as well as yarns which consist of or contain fibers of regenerated or native cellulose, oxycellulose behaving like cellulose in this respect.

For finishing material of this kind various substances are being used at present which are applied to or incorporated into the fiber, the term "finishing" excluding of course dyeing. Being foreign to the material to be treated these substances adhere only lightly thereto, and the usual preparations disclose not only very slight resistance to washing but in most instances are not even stable in water.

Finishing effects showing greater stability have successfully been produced only recently by the application of artificial resins to the fiber which as a rule are condensed thereon from components. It has further been proposed to form on the fiber condensation products with the cellulose itself after applying chemically active compounds, and according to another method certain dispersion agents obtained from metastable dispersions can be applied in a relatively firm manner. Although fastness to water is considerably increased in this way, resistance to washing unfortunately still remains quite low. The dispersing power of the usual washing agents is generally considerably greater than the adhesiveness of such substances. Furthermore, the application of these finishing processes is not simple, and it requires for instance extraordinary experience to keep damages to the fiber which occur in the course of these processes within reasonable limits.

To obtain certain effects another process has been suggested which consists in treating textiles containing cellulose with swelling media. In this process the cellulose is almost instantly fully converted into a transparent polysaccharide, and the goods produced are sold as glass batistes, organdies, etc., but these highly transparent effects are obtained at the expense of a thorogoing change of the fibrous structure. It is a peculiar fact that all known swelling agents can perform such swelling action only in certain concentrations while the reaction itself occurs at an extraordinary speed. The conditions prevailing in this respect are described for instance in German Patents Nos. 642,998 and 643,340. It is evident that owing to the change of the character of the goods the effect produced cannot be designated as finishing effect.

It is the object of the invention to produce in a similar manner a real finishing effect which resists washing and of course water and preserves the nature of the goods within wide limits, and the invention attains this object by providing for limited swelling, transparency developing either not at all or only to an insignificant extent.

Limited swelling can be produced in various ways, and the methods available for this purpose are briefly described below.

As in the known processes for obtaining transparent effects solutions may be used which per se are capable of causing extensive swelling and producing a transparent effect. These swelling agents, however, are applied to the fiber in quantities amounting only to 10% to 50% of the weight of the goods, so that it is necessary to thoroughly distribute this slight amount over the fiber. This can be done in a very simple manner by spraying the swelling solution in the form of mist or by employing a suitably adjusted squeezer.

Another method consists in applying the regular swelling agents in concentrations lower than those required for attaining transparent effects. It is not possible of course to use any low concentrations but those employed should have only slightly less strength than is required for producing transparent effects. This affords the advantage of working with baths.

Another possibility consists in using compounds which are capable of swelling only to a limited degree or which in any concentrations at the temperature employed yield only the desired limited swelling. Compounds of this type are therefore unable of producing transparent effects. They comprise chiefly mixtures of salts which per se do not produce a swelling effect but can do so in mixture with other salts or with each other, such as calcium and magnesium salts. More will be said about them below.

In the application of the three methods mentioned the agents in the bath or otherwise are permitted to act for a while, whereupon the goods are preliminarily dried if necessary and then rinsed and dried finally.

It has been found that the textile materials used for the tests were capable of reacting at different speeds, regenerated cellulose showing the quickest reaction and coarse native one the slowest.

When drying is effected after the slight, preferably superficial, swelling and removal of the swelling agent by rinsing, the surface of the fiber appears to be changed, as it is not smooth as before but seems to be covered with crater-shaped elevations and depressions. The mat surface thus produced is particularly desirable for goods

which previously had an unsightly luster, but the roughening of the surface increases also the apparent volume and owing to the reduction of the frequently excessive smoothness insures better workability and greater durability. Swelling further imparts a certain plasticity to the fiber or its surface with the result that the tensile and compressive stresses of the textile structure are extensively compensated whereby the fibers are adapted to one another. The fibers moreover approach one another and may even partially adhere to one another in a superficial way, so that the textile structure is stiffened and made more durable without any increase in weight as the finish is so to speak formed out of the fiber. This effect may be heightened still more by subjecting the plastic structure to pressure and/or heat. In this way tighter packing is obtained, the air spaces between the fibers and layers of fibers become smaller and the increase in the stiffness of the material after removal of the swelling agent is still greater. When yarns are treated in this manner and then defibered according to known methods, staples of single fibers will result which appear curly and can be made into woollike yarns and fabrics. As the matting of the surface has a similar effect as the scaly structure of wool fibers, material of this class may even be fulled when mixed with animal fiber.

Of the swelling media available salts are preferred, though acids and alkalies also produce good results. When acids are used, drying before rinsing should be omitted in view of saccharification. In case of alkalies a relatively strong formation of oxycellulose is often troublesome, so that lower concentrations should be given preference, which can easily be accomplished due to the wide scope of reaction of alkalies.

The following examples are intended to explain the process according to the invention without restricting the latter to the disclosures made.

Example 1

On a three roller foulard an artificial crêpe is passed between the second and third roller, the rollers being so adjusted that the fabric can take up 30% of 40° Baumé nitric acid. The goods that are only slightly moistened in this way are then permitted to lie for a while, whereupon they are thoroughly rinsed in flowing water and dried. The fabric has then acquired a full water-and wash-resisting feel.

Example 2

A zinc chloride solution of 67° Bé. is applied to garment material of cellulose wool to the extent of 30% of the weight of the fabric by means of a sprayer. The fabric is then rolled up and left in that condition for half an hour and afterwards thoroughly rinsed and dried. It will disclose a stable and fuller handle.

Example 3a

On a correspondingly adjusted squeezer an artificial silk tricot is passed in such manner that, by suitable squeezing, only 50% of phosphoric acid of 55° Bé. can be taken up. After approximately 15 minutes of this treatment the fabric is carefully rinsed with flowing water and then dried. The tricot has a fuller feel which is not harder, however, and possesses the desired stability.

Examble 3b

If the tricot passes through phosphoric acid of the same strength at normal squeezing pressure while absorbing acid equal to 100%–130% of its weight and is then instantly rinsed in water and dried, the material will become very stiff and be greatly injured so as to be practically useless.

Example 4

On a spraying machine a lining material is moistened with a 40° Bé. solution of calcium thiocyanate, rolled up for half an hour, then well rinsed and dried. This treatment imparts a stronger feel to the lining, which resists washing.

Example 5

To produce a water resisting finishing effect on a mixed fabric of wool or cellulose wool the fabric is passed on a squeezer through a 55° Bé. solution of phosphoric acid, the rollers being adjusted so that the fabric can take up solution to the extent of 50% of its weight. Being rinsed and dried the fabric will show the desired stable and full feel.

Example 6

The procedure is similar to that outlined in Example 5, except that sulfuric acid of 49° Bé. is used which produces a similar effect upon the mixed material.

Example 7

A printed cotton fabric is sprayed up to 30% of its weight with a 55° Bé. solution of phosphoric acid, rolled up for half an hour, then thoroughly rinsed while adding some alkali and dried. The fabric shows a full stable feel.

Example 8

The printed cotton fabric of Example 7 is passed through a bath of 21° Bé. soda lye on a foulard machine, and is then treated as described in the example. The result is also a full and stable feel.

Example 9

On a gumming machine a garment material of cellulose wool is passed through a bath of 8° Bé. soda lye, then allowed to lie for half an hour, well rinsed and dried. It will acquire the desired full and wash-resisting feel.

Example 10

The material treated according to Example 2 is passed on a gumming machine through a bath containing a 48° Bé. solution of zinc chloride, squeezed and dried. It will then show a similar stable feel as the material of Example 2.

Example 11

A washing-tricot of artificial silk is sprayed on a machine with a 55° Bé. solution of zinc chloride until the weight of the fabric has increased 30%. The fabric is then rolled up and left so for 30 minutes when it is passed through an embossing calender one roller of which is heated to 160° C. The fabric is then thoroughly rinsed and dried and shows a wash-resisting pattern.

Example 12

While a solution of 30 g. zinc chloride in 50 ccm. water, acting for hours on artificial silk which is then rinsed and dried, produces only a slight stiffening effect, even if the fabric is pressed in wet condition through rollers, and a solution of 50 g. calcium chloride (anhydrous) in 50 ccm. water is equally ineffective, will a solution containing 50 g. calcium chloride and 30 g. zinc chloride in 50 ccm. water yield a practically satisfactory effect already after short treatment which

can be increased still more by adding 5% to 25% urea or glycerin to the solution. In this mixture calcium chloride may be wholly or partly replaced by magnesium chloride which per se will not produce any effect at all. It is possible to add slight quantities of wetting agents like sodium butylnaphthalenesulfonate or sodium dodecanolsulfate.

Example 13

An artificial silk tricot is shortly treated in a vat with a solution at 50° C. which contains in 50 parts of water 50 parts of anhydrous calcium chloride and 30 parts calcium thiocyanate in solution. The fabric is then subjected to hydroextraction, allowed to rest for half an hour and thoroughly rinsed in warm water. This is followed by hydroextraction and drying. The fabric has a substantial feel unaffected by washing, particularly desirable for top shirts, looks almost like woven goods and shows great resistance to friction.

Example 14

A printed cotton fabric is treated on a foulard machine at 40° C. in a solution containing in 50 ccm. water 50 g. anhydrous calcium chloride, 40 g. anhydrous zinc chloride and 10 g. urea. The urea aids in swelling as does glycerin in similar manner. After squeezing the fabric is left lying for 10 to 20 minutes, thoroughly rinsed in ample quantities of cold or warm water, hydroextracted and dried. The goods treated with the solutions may also be dried at once and rinsed afterwards if the fiber is not damaged thereby. The fabric discloses a clear stiffening effect as often desired for period dresses and costumes.

Example 15

A garment material of cellulose wool is passed on a gumming machine through a bath comprising 40 parts water, 40 parts anhydrous calcium chloride and 50 parts concentrated formic acid. The fabric is squeezed off, allowed to rest for 30 minutes, strongly rinsed with cold water and dried. The feel produced is stable and full.

Example 16

An artificial silk lining is treated on a foulard machine in a bath of 6.5° Bé. soda lye to which 3% sodium aluminate has been added, then squeezed, thoroughly rinsed and dried. It has a full feel and its density and resistance to internal displacement are considerably increased. The effects produced will withstand normal washing. Soda lye of 6.5° Bé. alone produces only a slight effect and 3% sodium aluminate per se none at all.

Example 17

A cotton garment fabric is briefly treated in a bath as in Example 16, the bath containing 21° Bé. soda lye in which 5% zinc oxide is dissolved. The fabric has a full feel and resists washing while the feel produced with a 21° Bé. soda lye alone is much weaker.

Example 18

An artificial silk material of uniform color is treated on a foulard machine in a bath comprising 50 parts calcium chloride, 50 parts water, 30 parts zinc chloride and 20 parts urea. The fabric is then squeezed, hydroextracted and preliminarily dried, passed through an embossing calender and finally dried. The embossed effects will resist water and, partly, washing. In the same manner bushels of fibers and individual fibers can be shaped.

Example 19

If the effects according to the invention are to be obtained by means of baths, the concentration of the swelling agent should be lower than that required for producing transparent or parchment-like effects. These concentrations are for instance for phosphoric acid 50° Bé., for hydrochloric acid 20° Bé, for nitric acid 35° Bé., alkali hydroxides 10° Bé., zinc chloride 50 Bé., calcium thiocyanate 25° Bé., ammonical copper oxide 0.3% copper content, sulfuric acid 49° Bé. at −10° C. and 46° Bé. at room temperature. Solutions falling slightly below these values should be used in treating, whereupon rinsing is resorted to which if saltlike swelling agents are used might be interrupted by preliminary drying to be completed after rinsing.

On the other hand, if the method of applying 10% to 50% of the agent to the fiber is employed, the concentrations stated in the preceding paragraph may be used and even exceeded.

KURT QUEHL.

Published Apr. 27, 1943

Serial No. 223,269

ALIEN PROPERTY CUSTODIAN

WORK TURNING DEVICE FOR MACHINE TOOLS

Kurt Zwick, Munchen, Germany; vested in the Alien Property Custodian

Application filed August 5, 1938

The present invention deals with a device for turning work as it is traversed with respect to a tool operating upon the work. Work turning devices of this kind, although capable also of other uses, are especially helpful in connection with cutting, grinding, sharpening, or otherwise acting upon work having one or more spiral or helical portions, such as milling cutters, spiral or helical gears, etc.

An object of the invention is the provision of a generally improved and more satisfactory work turning device of the character above indicated.

Another object is the provision of a simple work turning device, easy and comparatively inexpensive to construct, having relatively few and simple moving parts, and sturdy in operation.

Still another object is the provision of a work turning device capable of providing a wide range of ratios of turning of the work to longitudinal movement thereof.

A further object is the provision of a work turning device capable of easy and quick adjustment to set the work in correct initial position with respect to the tool.

A still further object is the provision of a work turning device capable of operating easily with respect to conical work as well as cylindrical work.

To these and other ends the invention resides in certain improvements and combinations of parts, all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.

In the drawings:

Fig. 1 is a diagrammatic plan of a work turning device constructed in accordance with a preferred embodiment of the invention;

Fig. 2 is a similar view showing a modified form of construction;

Fig. 3 is a similar view showing still another modification;

Fig. 4 is a similar view with the device so constructed as to handle conical work;

Fig. 5 is a similar view of another modification;

Fig. 6 is a perspective view of still another modified form;

Fig. 7 is a diagrammatic plan of still another modification in which interchangeable gears are employed to obtain a greater change in ratio of turning of the work to longitudinal movement of the work;

Fig. 8 is a section taken substantially on the line 8—8 of Fig. 7;

Fig. 9 is a similar section through a modification of the construction shown in Figs. 7 and 8, with the gears arranged for one ratio of turning movement;

Fig. 10 is a similar section with the gears arranged for still another ratio of turning movement;

Fig. 11 is a similar section with the gears arranged for still another ratio;

Fig. 12 is a diagrammatic plan illustrating details of an adjustable mounting for the track of the present invention;

Fig. 13 is a section taken substantially on the line 13—13 of Fig. 12;

Fig. 14 is a diagrammatic plan illustrating a modified form of rotary member for rolling on the track;

Fig. 15 is an edge view of such rotary member;

Fig. 16 is a similar edge view of another form of rotary member, in one position, and

Fig. 17 is a view of the same in an inverted position.

The same reference numerals throughout the several views indicate the same parts.

In performing grinding and other operations upon spiral or helical milling cutters and on certain types of gears and other spiral or helical work, it is of great importance that the work be turned accurately in exact accordance with a predetermined ratio of turning to the longitudinal movement of the work relatively to the tool. Heretofore it has been proposed to drive the work in its turning movements from the same shaft or source of power that produces the longitudinal feeding movement of the work relatively to the tool. This prior arrangement is open to the grave disadvantage that it requires special and expensive gearing and relatively complicated and cumbersome mechanism.

According to the present invention, the longitudinal feeding of the work and the turning movement thereof are not both drive direct from a common source of power, but the turning movement of the work is accomplished by the turning of a rotary member mounted to move bodily with the work, which rotary member rolls on a track mounted on the frame of the machine. Thus the turning of the work is accomplished directly from the longitudinal movement of the work relatively to the tool, which results in a great simplification of the cumbersome and expensive structures heretofore employed.

For the sake of a convenient example, the invention is illustrated in the present application in connection with operations upon a helical milling cutter, that is, a milling cutter with helical or generally helical cutting teeth. It is to be under-

stood that reference to a milling cutter is merely for the sake of a convenient example, and that the invention is equally applicable to worm gears, spiral or helical gears, or any other work having generally helical or spiral surfaces to be operated upon.

Referring now to Figs. 1 to 6 of the drawings, there is indicated diagrammatically at 21 a portion of the frame of the machine, which frame is provided with a guideway 23 along which a carriage 25 is movable. On this carriage is mounted a hollow shaft 27 on which the work 29 to be operated upon is clamped in any suitable known manner e. g. by means of a hand knob 30. A tool 31 is mounted on the frame 21 or any other suitable part of the machine in position to cooperate with and act upon the work 29 as the work is traversed past the tool by moving the carriage 25 along its guideway 23. The tool 31 may at times be a fixed tool, such as a planer tooth or the like, or it may be a rotating tool, such as a grinding member or milling member mounted on the rotating shaft 33 driven from any suitable source of power (not shown). Power means of any conventional kind may also be provided for moving the carriage 25 along its guideway 23, or the carriage may be moved by hand, by turning a feeding screw or the like.

When the machine is to be used for operating always upon substantially cylindrical work, the shaft 27 which carries the work 29 may be arranged permanently in a direction substantially parallel to the direction of the guideway 23. If the machine is to be used only for conical work always of the same angle of inclination, then the shaft 27 may be arranged permanently at a corresponding angle to the direction of the guideway 23. But when, as is preferably the case, the machine is designed so that it can be used with conical work of different angles. and also with cylindrical work, then the carriage 25 is preferably made in two sections, as indicated in Fig. 4 at 25*a* and 25*b*, the section 25*b* being pivoted to swing relatively to the section 25*a* about a pivot axis 41 lying in a plane preferably perpendicular to the direction of the guideway 23.

For convenience of adjustment, the section 25*a* may be provided with graduations 43 in degrees or other suitable units, cooperating with an index mark 45 on the section 25*b*, so that the parts may be set to any desired angular position within a reasonable range, and may be clamped in such position by means of a clamping nut 47 on a bolt mounted on the section 25*a* and extending through an arcuate slot 49 in the section 25*b*. By this arrangement, the axis of the shaft 27 may be shifted to a non-parallel position with respect to the direction of the guideway 23, so that the tool 31 may operate upon conical work, as indicated at 29*a* in Fig. 4. This same arrangement for adjusting the angular position of the axis of the shaft 27 relatively to the axis of the guideway 23 may be used with any of the different forms of tracks and cooperating rotary members shown in Figs. 1, 2, 3, and 6, but has been omitted from these figures for the sake of simplifying the drawings.

In order to turn the work relatively to the tool as the work moves past the tool, there is provided on the frame of the machine a track designated in general by the numeral 51, cooperating with a rotary member mounted on the carriage 25 and designated in general by the numeral 53, which rotary member rolls on and is turned by the track as the carriage is moved along the frame, the rotary member being operatively connected to the work shaft 27 to turn this shaft and the work fastened thereto.

The track 51 extends in general in a direction parallel to the direction of the guideway 23 and it may be either rigid or flexible. The track and the associated rotary member which rolls upon it may take various forms without departing from the present invention. For example, as shown in Fig. 1, the track 51*a* may be in the form of a toothed rack, and the rotary member 53*a* may be a toothed gear meshing with the rack. In this case the track may be mounted (preferably removably) on a bracket 55 secured to the machine frame 21, preferably in an adjustable manner as set forth below.

In the embodiment shown in Fig. 2, the rotary member 53*b* may be in the form of a wheel without teeth, having a periphery suitably roughened or provided with friction material such as rubber or the like, to roll upon and be turned by contact with the track 51*b* in the form of a bar without teeth (preferably also roughened to increase its friction with the wheel 53*b*, or provided with a rubber coating or the like) which is mounted on arms 57 guided for movement in the bracket 55 in directions transverse to the length of the track. Springs 59 constantly tend to push the track 51*b* toward the wheel 53*b* and thus keep these parts in frictional engagement with sufficient force to cause the wheel to turn as it rolls along the track.

In Fig. 3, the track 51 is a flexible band or cord 51*c*, preferably in the form of steel or other metallic wire, wrapped one or more times around the rotary member 53*c*, so that as the carriage 25 moves along the guideway 23, successive portions of the flexible track 51*c* are constantly being wound onto the wheel 53*c* and other portions thereof are constantly being unwound therefrom. Preferably one end of the flexible track 51*c* is fixed to one point of the supporting bracket 55, as indicated at 61, and the other end of the track is secured to a shaft 63 rotatably mounted in the bracket 55 at another point, to which shaft is fixed a ratchet 65 cooperating with a pawl 67 so that the shaft 63 may be turned to tighten the track band 51*c* to any desired degree of tightness and the pawl and ratchet will hold the track in its tightened condition.

In Fig. 4, the track 51*c* and wheel 53*c* may be the same as mentioned in connection with Fig. 3. The track 51 may also take the form of a rack bar 51*d* (Fig. 5) the teeth of which, instead of running straight across the track, may be oblique as indicated in dotted lines, so as to mesh with spiral or helical teeth on the rotary member 53*d* in the form of a spiral or helical gear, mounted directly on the shaft 27.

In the arrangement shown in Fig. 6, the rotary member 53*e* is also mounted directly on the work carrying shaft 27, and is in the form of a wheel without teeth, which rolls on the track 51*e* in the form of a flexible member like the track 51*c* in Fig. 3. Due to the arrangement of the wheel 53*e* in a plane transverse to the direction of movement of the carriage 25 along the guideway 23, it is necessary here to run the track band 51*e* over intermediate guide rollers 71 and 73 mounted on the carriage 25. One end of the track band 51*e* is secured to a shaft 61*e* while the other end is secured to a shaft 63*e*, these shafts being mounted either directly on the machine frame 21 or preferably on a bracket 55 like that mentioned above. The shaft 63*e* may have the same ratchet

65 and pawl 67 as shown in Fig. 3, for the purpose of tightening the band 51*e*.

In all of these arrangements, the rotary member 53 which rolls on the track is operatively connected in a suitable manner with the shaft 27, so that rotation of the rotary member is transmitted to the shaft. In the arrangements shown in Figs. 5 and 6, the rotary members 53*d* and 53*e* are removably mounted directly on the work holding shaft 27, no intermediate transmission gears being necessary. By removing these rotary members and substituting other rotary members of different diameters, a different ratio of turning movement to longitudinal movement of the work is attained. To turn the work in the opposite direction, the toothed track member 51*d* (Fig. 5) and rotary member 53*d* may be removed and replaced by another track member and rotary member with oblique teeth in the opposite direction; or if the rotary member 53*d* is provided with radial pins rather than complete teeth, then for a reversal of the direction of rotation it is necessary only to replace the track member 51*d* with another track having its teeth in the reverse direction, without replacing the rotary member 53*d*.

A reversal of direction may be attained with the arrangements shown in Fig. 6, by reversing the threading of the flexible track 51*e* relatively to the rotary member 53*e*. That is, the left end of the track can be placed near the bottom of the shaft 61*e* instead of near the top thereof, so that it extends to the bottom of the rotary member 53*e*, while the right hand portion of the track may leave the top of the rotary member 53*e* and extend thence to a point near the top of the shaft 63*e*. The shafts 61*e* and 63*e* and the rollers 71 and 73 are sufficiently long to accommodate considerable change in the height of the track, when the direction of rotation is to be reversed or when a larger or smaller diameter of rotary member is to be substituted to obtain a different ratio of rotation of the work relatively to longitudinal movement thereof.

Usually it is preferred not to have the rotary member 53 mounted directly upon the work holding shaft 27, as in Figs. 5 and 6, but to mount it on a separate shaft 75, as shown in Figs. 1 to 4, the axis of which is approximately in a plane perpendicular to the direction of movement of the carriage 25 along the guideway 23. This permits a more favorable location of the rotary member 53 with respect to the track 51, for the rotary member may rotate approximately in a plane parallel with the direction of travel of the carriage, making it easier to adjust the track to different diameters or positions of rotary members, and obviating the necessity of providing oblique teeth on the track, as in Fig. 5, or guide rollers 71 and 73, as in Fig. 6.

In the arrangement shown in Figs. 1 to 4, the shaft 75 carries a bevel gear 77 meshing with another bevel gear 79 on the shaft 27. Preferably these bevel gears have oblique teeth in order that, by suitable adjustment between the gears, backlash or play may be taken up or reduced to a minimum, giving greater accuracy. If desired, both of the gears 77 and 79 may be removably clamped on their respective shafts so they may be easily replaced by other gears of different diameters, to vary the transmission ratio between the shaft 75 and the shaft 27.

A change in the ratio of turning movement to longitudinal movement of the work thus may be obtained either by replacing the rotary member 53 with another rotary member of different diameter, or by changing the bevel gears 77 and 79 for other gears of different sizes, or by changing both the rotary member and the bevel gears. Usually a change of the bevel gears, although possible, is somewhat inconvenient. Also, when the rotary member does not have teeth as in Fig. 1, but is driven by friction as in Figs. 2, 3, and 4, the use of a rotary member of very small diameter for obtaining the desired turning ratio is undesirable because it may cause slippage of the rotary member relative to the track on which it rolls, and the use of a rotary member of very large diameter is undesirable because it is cumbersome and requires an undesirably great space between the track and the axis of rotation of the rotary member. For these reasons it is desirable to have some convenient and easy way of changing the transmission ratio in order to avoid the use of excessively large or excessively small diameters of rotary members when the work is to be turned very slowly or very fast relatively to its longitudinal travel, and to accomplish this the arrangements shown in Figs. 7 to 11 are preferably employed.

Referring first to Figs. 7 and 8, instead of mounting the rotary member 53 directly on the shaft 75 which carries the bevel gear 77, the rotary member may be mounted on another shaft 81 journaled in the carriage 25 and approximately parallel to the shaft 75. The rotary member 53 may be carried by a sleeve 83 and spaced by a spacer sleeve 85 from a small gear 87 also detachably carried by the sleeve 83. A pin 89, extending through the sleeve 83 and threaded into the shaft 81, holds the parts firmly together, locking them to each other so that the members 53, 81, and 87 all turn together as a unit. The gear 87 meshes with a large gear 91 detachably mounted on another sleeve 93 held on the shaft 75 by a threaded pin 95 similar to the pin 89. A removable cover 97 encloses the gears 87 and 91, and has an opening through which the spacer 85 extends, so that the rotary member 53 is outside the cover 97 and may roll upon the track 51.

The two sleeves 83 and 93 have their ends which fit into the shafts 75 and 81 of the same diameter, so that either sleeve may be placed interchangeably in either shaft, and the gear receiving parts and rotary member receiving parts of the two sleeves are also of the same diameter, so that the rotary member or either gear may be placed on either sleeve. The cover 97 is reversible so that the opening therein may be brought into alinement with either shaft. When the gears are arranged as shown in Figs. 7 and 8, the work shaft 27 is turned quite slowly relatively to the longitudinal feeding of the work, without the use of a rotary member 53 of such a large diameter that it would be cumbersome.

If the gears are reversed, placing the large gear 91 on the sleeve 83 on the shaft 81, and placing the small gear 87 on the sleeve 93 on the shaft 75, then the work shaft 27 is turned quite fast with respect to the longitudinal feeding of the work, without the necessity of using a rotary member 53 of such small diameter that there would be danger of slipping on the track. When operating upon work pieces which can be turned by using rotary members of favorable diameter without intermediate gears to change the transmission ratio, then the long sleeve 83 and the rotary member 53 may be mounted on the shaft 75 rather than the shaft 81, so that the rolling of the member 53 on the track turns the shaft

75 directly, the transmission gears 87 and 91 not coming into play.

Replacement of the gears 87 and 91 by other gears of different diameter, to give still other transmission ratios between the rotary member and the work, is also possible whenever desired.

If a still greater range of change in transmission ratio than that provided by the arrangement shown in Figs. 7 and 8 is desired, then the gearing shown in Figs. 9, 10, and 11 may be employed. Here, the shafts 75 and 81 remain as before, the bevel gear 77 being mounted as before on the shaft 75 for meshing with the bevel gear 79 on the work holding shaft 27.

The sleeve 83*a*, corresponding in general to the sleeve 83 in Figs. 7 and 8, is fastened as before by a threaded pin 89*a*, either to the shaft 81, when only one gear transmission stage is desired between the rotary member 53 and the bevel gear shaft 75, or to the shaft 75, when more than one gear transmission stage is desired between these parts. Rotatably mounted on the sleeve 83*a*, in either event, is a bushing 101 having at its lower end a flange 103. Either one of the gears 87 and 91, corresponding to the gears of the same numbers in Figs. 7 and 8, may be removably mounted on the bushing 101 and seated against the shoulder 103 thereon. On the bushing above the gear is a spacing sleeve 105 which has a flange underlying the edge of a cover 97*a*, corresponding in general to the cover 97 in Figs. 7 and 8, to prevent endwise movement of the bushing 101 off of the sleeve 83*a*. The rotary member 53 is placed on the bushing 101 above the spacing sleeve 105, and is clamped thereon by the threaded cap 107 which is screwed down sufficiently tightly onto the bushing 101 to lock both the rotary member 53 and the gear non-rotatably to the bushing.

Another sleeve 93*a*, corresponding in general to the sleeve 93 in Figs. 7 and 8, carries a bushing 109 of the same diameter and shape as the lower part of the bushing 101, in order that either bushing may receive interchangeably either of the gears 87 and 91. The sleeve has a flange 111 at its upper end, overlying the gear and the bushing.

The lower portions of the two sleeves 83*a* and 93*a*, below the respective bushings 101 and 109, are of the same diameter, so that either one of a pair of gears 113 and 115 may be interchangeably mounted on these portions of the sleeves, or if it is not desired to use these gears, either one of them may be replaced by a spacing collar 117 of similar internal diameter. Tightening of the threaded pin 89*a* in the sleeve 83*a* will force this sleeve downwardly into the shaft 75 or 81 on which it is mounted, clamping the gear 113 or 115 or the spacing collar 117 (whichever of these three happens to be mounted on this sleeve) tightly between a shoulder on the sleeve and the end of the shaft, in a non-rotatable manner, without affecting the rotation of the bushing 101 on the sleeve.

Tightening of another pin 95*a* in the other sleeve 93*a* will cause the flange 111 to bear downwardly on the gear 87 or 91 mounted on the bushing 109, and will cause this bushing to bear downwardly on the gear 113 or 115 or the spacing collar 117, whichever is mounted on this sleeve, clamping all of these parts non-rotatably to whichever shaft 75 or 81 the sleeve 93*a* is mounted upon.

With this construction, several arrangements are possible, depending on the particular requirements of the work to be operated upon. For example, when only a single transmission stage between the rotary member 53 and the shaft 75 is required, the sleeve 83*a* may be placed on the shaft 81, and the sleeve 93*a* on the shaft 75, as indicated in Fig. 9. In this case, only one of the pair of gears 113 and 115 is used, the other being replaced by the spacing collar 117 which can be mounted on either of the sleeves 83*a* and 93*a*. When the small gear 87 is mounted on the bushing 101 on the sleeve 83*a*, and the large gear 91 is mounted on the sleeve 93*a*, then the parts function in substantially the same way as those illustrated in Figs. 7 and 8, the turning of the rotary member 53 producing relatively slow rotation of the shaft 75 and of the work shaft 27. If the gears 87 and 91 are exchanged, so that the large gear is directly connected to the rotary member 53 and the small gear is mounted on the shaft 75, then the rotation of the shaft 75 is speeded up relatively to the turning of the rotary member 53.

If still further slowing down or speeding up of the rotation of the work is required, it can be done without resort to a rotary member of unfavorable diameter, by placing the parts in the position shown in Fig. 10, for relatively slow rotation of the work, or in Fig. 11, for relatively fast rotation of the work. In both cases the sleeve 83*a* and the rotary member 53 are shifted from the shaft 81 to the shaft 75, as shown, the cover 97*a* being reversible so that the hole in the cover may be alined with either shaft. For slow rotation of the work, the small gear 87 is connected directly to the rotary member 53 by being placed on the bushing 101, and it drives the large gear 91 clamped on the sleeve 93*a* on the shaft 81. Turning of this shaft also turns the small gear 113 clamped thereto, which turns the large gear 115 clamped to the shaft 75.

For very fast rotation of the work, without the use of an unfavorably small diameter of rotary member, the gears may be rearranged as shown in Fig. 11. Here, the large gear 91 is mounted on the bushing 101 and turns with the rotary member 53, and this turns the small gear 87 on the shaft 81 at a greater speed. The large gear 115, clamped on the shaft 81 and turning therewith, then drives the small gear 113 on the shaft 75 at an increased speed.

In addition to rearranging the gears 87, 91, 113, and 115 in the different positions above mentioned, it is also possible to replace these gears by still other gears of different diameters, if a greater variety of transmission ratios is desired.

The work may be turned in either direction as required without necessitating any change in the gear transmission, but simply by changing the relationship of the rotary member and the track on which it rolls. Thus, if the work in Fig. 1 is to be turned in the opposite direction, the track 51*a* is detached from the bracket 55 and replaced in a reverse position, with the teeth along the inner edge rather than the outer edge of the track. The bracket 55, which is adjustably mounted on the frame 21, is shifted further outwardly with respect to the frame so that the track will lie on the opposite side of the rotary member 53*a*, which will be turned in the opposite direction for a given direction of movement of the carriage 25 along the guideway 23.

A similar change may be made in the Fig. 2 construction when the work is to be turned in the opposite direction, by replacing the track 51*b* with a similar track tangent to the opposite side of the rotary member 53*b*, and having longer guide arms 57. The compression springs 59 would

be replaced by tension springs tending to pull the track inwardly toward the bracket **55** and against the periphery of the rotary member.

Likewise, in the construction shown in Figs. 3 and 4, the flexible track **51***c* would be wrapped in the opposite direction around the rotary member **53***c*, the bracket **55** being shifted outwardly with respect to the frame **21** so that the track would leave the periphery of the rotary member at the opposite side thereof. The manner in which a reversal of direction can be secured with the constructions shown in Figs. 5 and 6 has already been explained.

To attain easily this change of direction of rotation of the work, especially with the track and rotary member constructions shown in Figs. 1 to 4, it is advisable, as already stated, that the bracket **55** should be adjustably mounted on the frame **21**. Various forms of adjustable mounting of the bracket are possible, within the scope of the invention. For example, the bracket may be held to the frame **21** by a bolt **121** passing through a long slot **123** in the bracket, so that when the bolt is loosened, the bracket may be moved in the direction of the slot, to place the track along either desired side of the rotary member, or to position the track for cooperation with different rotary members of different diameters.

A preferable form of mounting, however, is that shown in Figs. 12 and 13, where the track **51**, whether of rigid or flexible form, is mounted on bracket arms **55***a* extending in the general direction of the track and rigidly attached to a transverse arm **55***b* slidably mounted in a block **125** on the frame **21**, and clamped in the block by a clamp screw **127**. When this clamp is loosened, the arm **55***b* may be moved in the direction of its length through the block **125**, to bring the track **51** into cooperation with either side of the rotary member **53**, and with rotary members of different diameters. If the track **51** is in the form of a toothed rack, it may be a separate rack secured to the bracket arms **55***a*, or may be in the form of teeth formed integrally in the face of the arms **55***a*. If the track is in the form of a band or flexible member, the ends thereof may be secured to suitable studs, lugs, or shafts on the arms **55a**, and the same ratchet **65** and pawl **67** arrangement previously described (Figs. 3 and 6) may be employed for tightening the track.

For the purpose of adjusting the track longitudinally with respect to any given position of the carriage **25**, to position the work **29** accurately with respect to the tool **31**, the entire block **125** is preferably mounted to slide on the frame **21** along the guideway **131** (Fig. 13) in a direction substantially parallel to the length of the track. A feeding screw **133** mounted on the block **125** is threaded through a stationary block **135** on the machine frame, so that by turning the feeding screw **133**, a fine adjustment of the block **125** along the guideway **131** is obtained.

After one grinding operation on the work has been performed, as for example the grinding of one helical tooth on the cutter, then the work must be turned a fraction of a revolution relatively to the tool in order to bring the next helical tooth of the work into cooperation with the tool. This may be done conveniently by shifting the track lengthwise relatively to the work, by operating the feeding screw **133**. Alternatively, it may be done by turning an adjusting graduated member **143** (Figs. 1 to 7, 12, and 14) mounted on the end of the shaft **27** and cooperating with an index mark **145** on the carriage **25**. Preferably a suitable releasable clutch or coupling is interposed between the shaft **27** and the bevel gear **79**, so that by releasing this connection, the shaft **27** and work **29** may be turned by the member **143**, without turning the rotary member **53**.

It is frequently convenient to make the rotary member with two or more portions of different diameters, so that the track may cooperate with a portion of one diameter when one work turning ratio is to be used, and with a portion of another diameter when another work turning ratio is to be used, without the necessity of removing the rotary member and replacing it with a different one. Such a stepped or multiple-periphery rotary member may be employed either with a toothed rotary member for cooperation with a toothed track as in Fig. 1, or with a smooth rotary member for rolling along a smooth rigid track as in Fig. 2, or with a rotary member intended to have a flexible track wrapped around it as in Figs. 3, 4, and 6. Figs. 14 to 17 illustrate this idea as applied to the latter form of rotary member.

In Figs. 14 and 15, the rotary member indicated in general at **53** has a peripheral portion **53***x* of one diameter and another peripheral portion **53***y* of a larger diameter. If desired, radial flanges **151** may be employed between the two surfaces **53***x* and **53***y* and at the extreme edges of these two surfaces, to prevent the track from slipping laterally off of the intended surface.

In using this arrangement, the track **51** may be shifted in a direction axially of the shaft **75** on which the rotary member **53** is mounted, to bring the track into cooperation with one or another of the surfaces on the rotary member. Or, if preferred, the track may stay permanently in the plane of one of these surfaces on the rotary member, and if cooperation with the other surface is desired, the rotary member may be removed from the shaft **75** and replaced in an upside down position, thus bringing the other peripheral surface into the plane of the track.

The stepped idea may be employed when more than two diameters are desired on the rotary member, as shown in Figs. 16 and 17, where the rotary member is again indicated in general by the numeral **53**, and it has a series of steps or peripheral portions of different diameters, as shown. As before, flanges **151** may be employed to separate the different surfaces from each other. The track may be shifted in a direction axially of the shaft **75** to bring it into cooperation with one or another of the surfaces on the rotary member. Or if this involves too great a shifting of the track, then the track may be shifted to a limited range to bring it into cooperation with some of the different surfaces on the rotary member, and for cooperating with other surfaces, the rotary member may be removed from the shaft and replaced in an upside down position. Or again, spacing members **153** may be employed on the shaft **75** to place the rotary member **53** at the proper height so that the track cooperates with the desired peripheral portion. For instance, when the track is to cooperate with the portion of greatest diameter, as in Fig. 16, two spacing collars **153** may be placed below the rotary member **53** and no spacing collars above it, each collar preferably having an axial length equal to the axial spacing of the successive rolling portions of the rotary member. If the track is to cooperate with the next to the largest

portion, one spacing collar 153 may be used below the rotary member, and one above it, thus bringing this second portion into the plane of the track, without shifting the plane of the track. If rolling of the track on the second from the largest diameter portion is desired, then both of the spacing collars may be placed above the rotary member. For the other three portions of different diameters, the rotary member may be removed from the shaft and turned upside down as in Fig. 17, and used with two collars, one collar, or no collar below it, depending on which portion the track is to run upon.

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PUBLISHED
APRIL 27, 1943.
BY A. P. C.

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WORK TURNING DEVICE FOR MACHINE TOOLS

Filed Aug. 5, 1938

Serial No.
223,269

5 Sheets-Sheet 1

Fig. 1

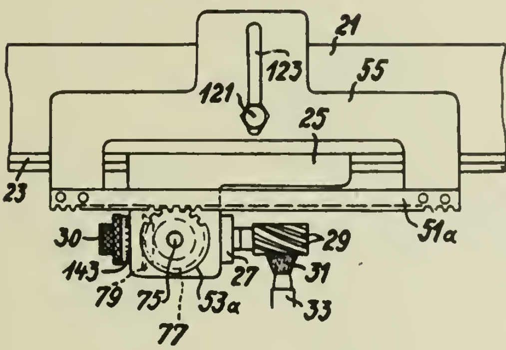


Fig.2.

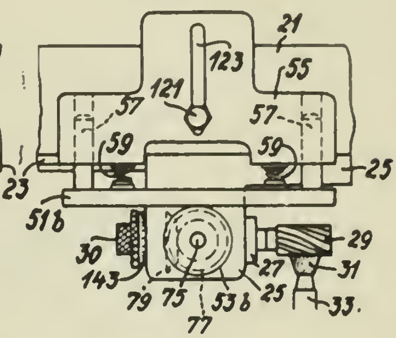
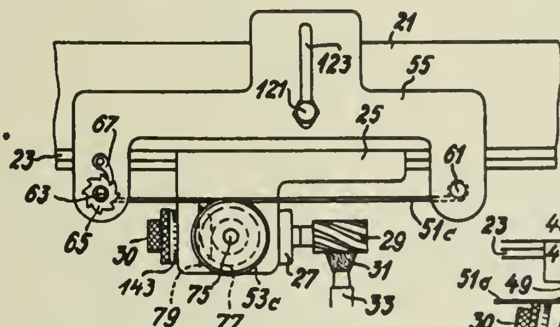


Fig. 1.



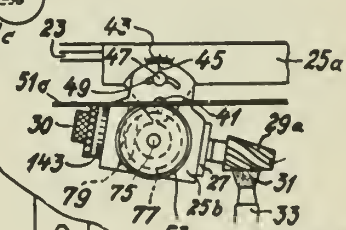


Fig.2.

Fig.5.

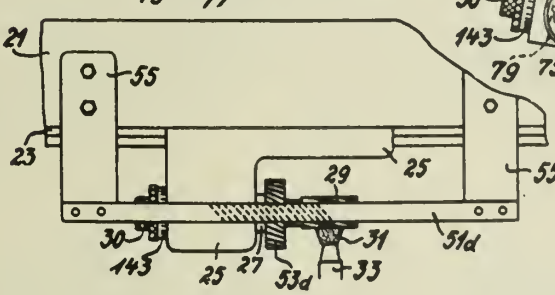
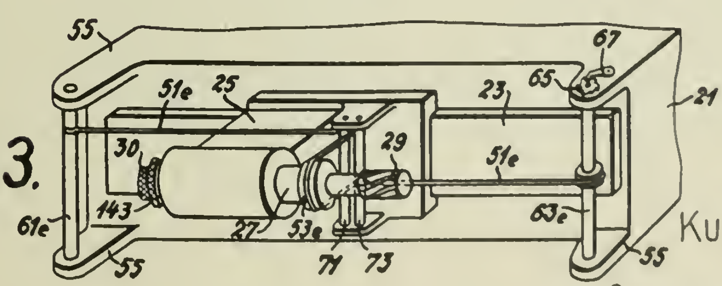


Fig.3.



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Filed Aug. 5, 1938

Serial No.
223,269

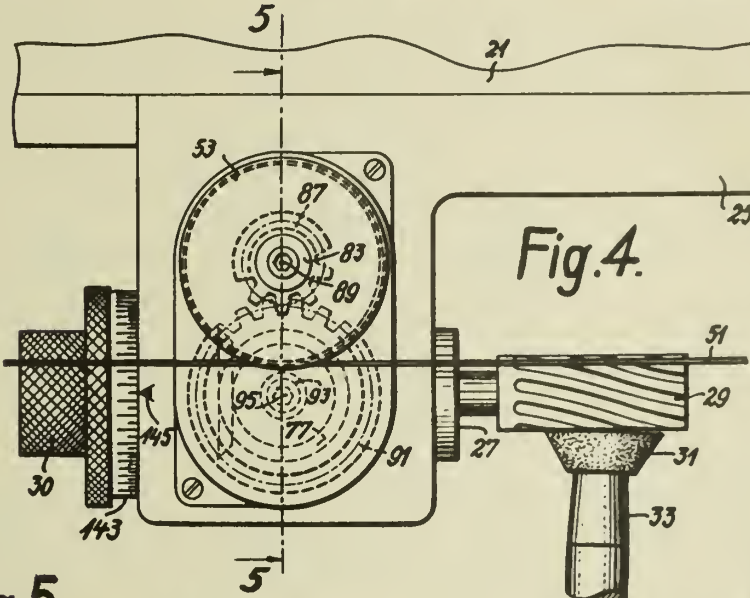


Fig.4.

Fig.5.

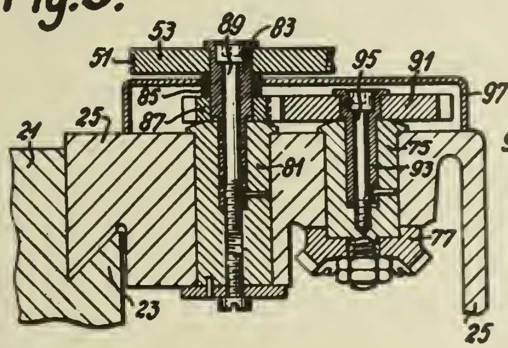


Fig.7.

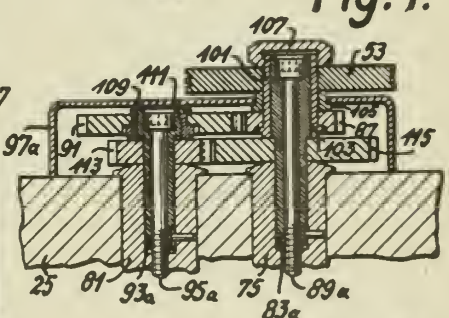


Fig.6.

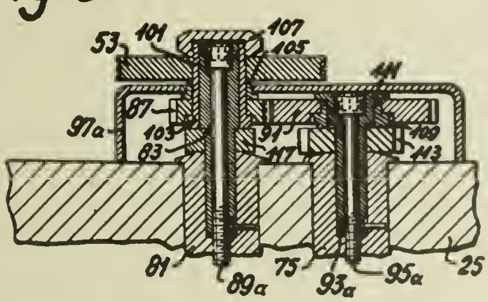
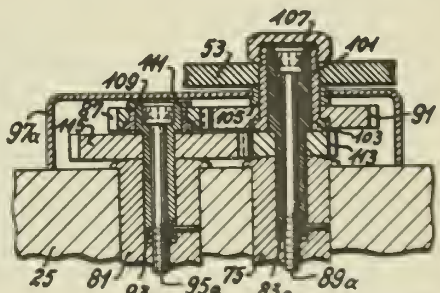


Fig.8.



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PUBLISHED
APRIL 27, 1943.
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WORK TURNING DEVICE FOR MACHINE TOOLS
Filed Aug. 5, 1938

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223,269
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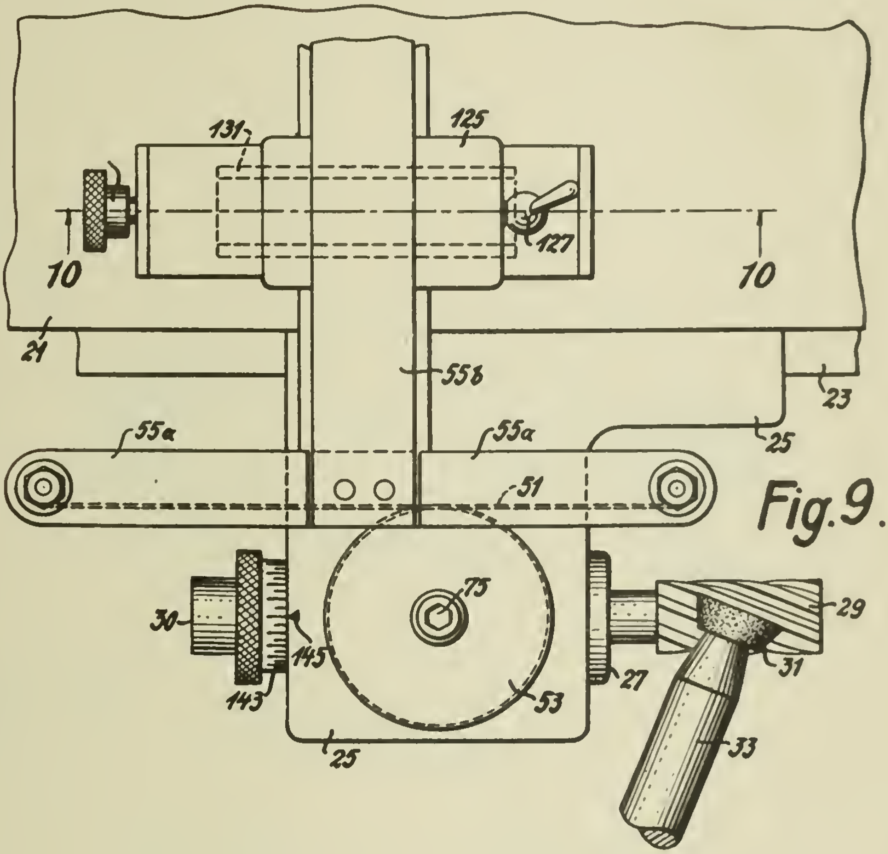

Fig. 9.

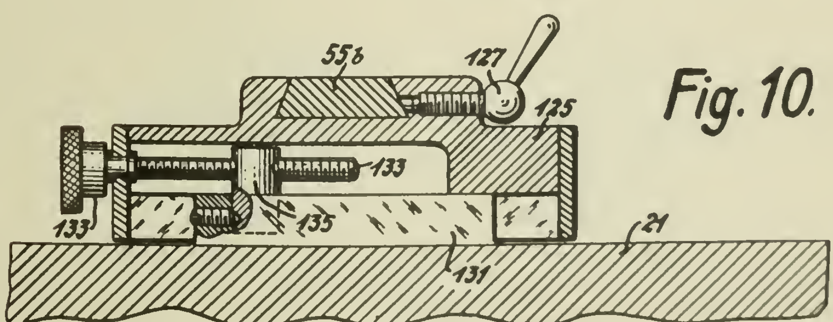

Fig. 10.

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PUBLISHED
APRIL 27, 1943.
BY A. P. C.

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WORK TURNING DEVICE FOR MACHINE TOOLS
Filed Aug. 5, 1938

Serial No.
223,269
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Fig. 11.

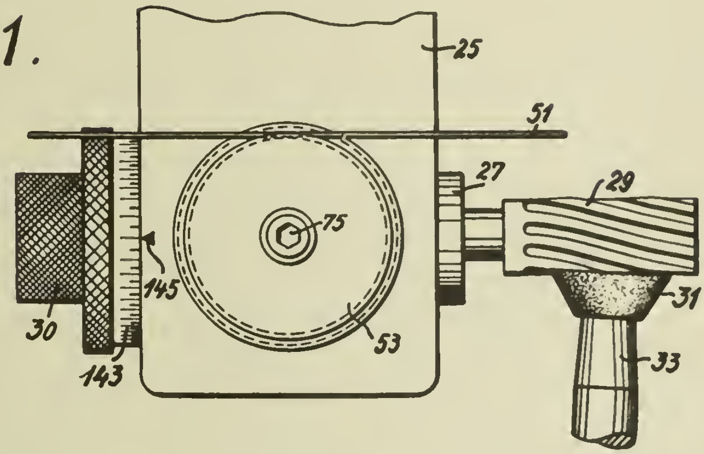


Fig. 12.

Fig. 13.

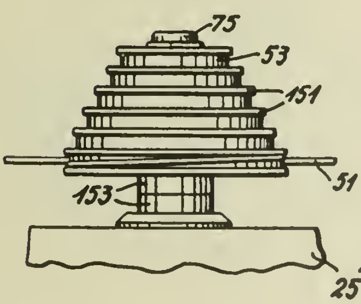
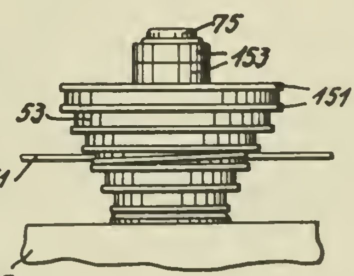


Fig. 14.



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PUBLISHED
APRIL 27, 1943.
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WORK TURNING DEVICE FOR MACHINE TOOLS
Filed Aug. 5, 1938

Serial No.
223,269
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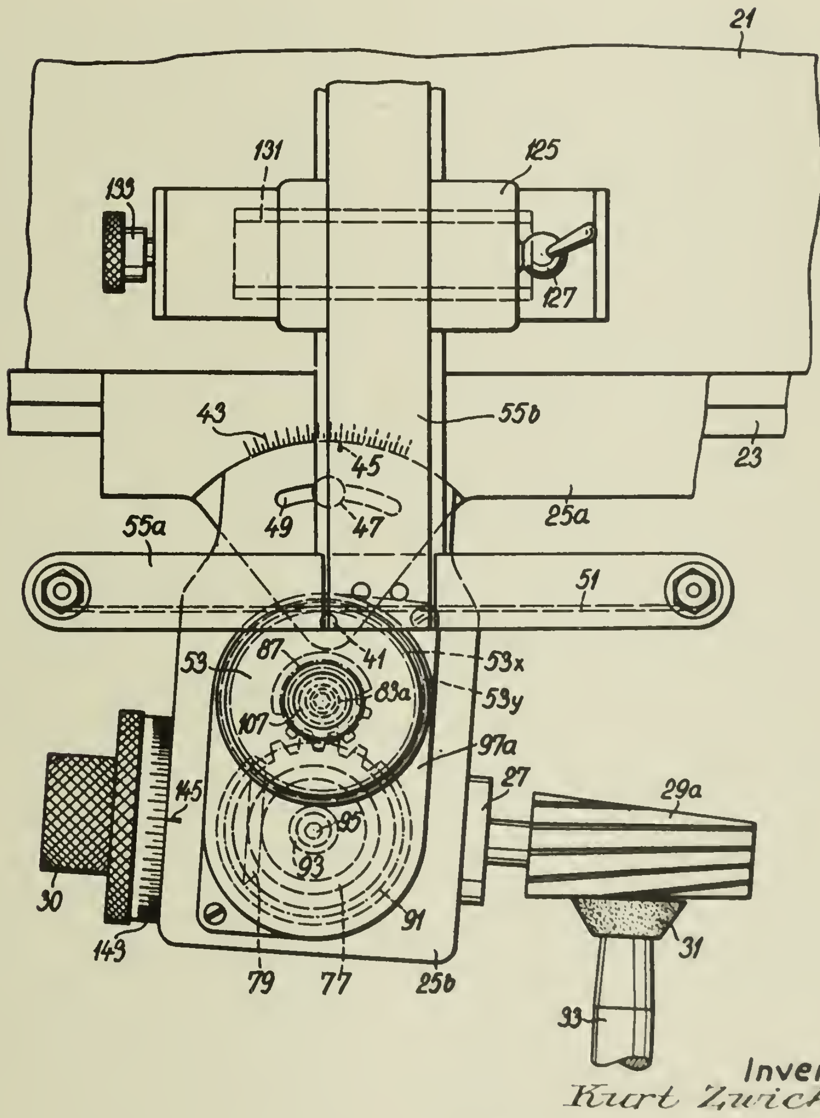
Fig. 15



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Published Apr. 27, 1943

Serial No. 225,207

ALIEN PROPERTY CUSTODIAN

METHOD AND APPARATUS FOR SPINNING

Anton Formhals, Mainz, Germany; vested in the Alien Property Custodian

Application filed August 16, 1938

This invention relates to the production of artificial fibers and more particularly it relates to the dispersion or shattering of streams of spinning solution into comparatively fine fibers by means of a high potential electrical field of certain characteristics and collecting said fibers substantially parallel to each other in the form of a continuous fiber band on a moving collecting device. The dispersion of a stream of spinning solution into fibers by a high electrical potential shall hereinafter, for convenience, be referred to as the "electrical spinning" of fibers.

In accordance with previously known apparatus and methods for the electrical spinning of fibers, for example, the apparati and methods disclosed in U. S. Patent 1,975,504 to Formhals, U. S. Patent 705,691 to Morton and U. S. Patent 2,048,651 to Norton, a number of difficulties have been experienced. Due to the comparatively short distance intervening between the solution feeding devices and the fiber collecting devices it was exceedingly difficult to sufficiently completely dry out the formed fibers, and as a result the said fibers would tend to stick not only to the collecting devices but also to each other. Furthermore, in the previous methods the formed fibers would not tend to collect in a compact closely aggregated form. While this was due partly to the fact that the collecting electrodes presented continuous plane or curved surfaces for receiving the fibers and to the use of serrated devices for feeding discontinuous quantities of spinning solution into the high potential electrical field, the apparatus would still not collect the fibers in a compact concentrated fashion even though continuous streams of spinning solution were fed into the electrical field. Particularly when a plurality of spinning nozzles was used it was found that the streams, and the fibers formed from said streams, would take different courses and paths to the collecting device, thus preventing the formation of a closely packed or aggregated fiber band on the collecting device. In other words, while the paths which the streams and fibers might take between the feeding and the collecting devices were determined to an approximate degree by the relative position of these devices to each other, it was not possible to predetermine this path precisely and constantly, nor was it possible to predetermine the paths of all of the streams and fibers therefrom in a perfect manner from the different nozzles.

A further difficulty of previous apparatus and methods was experienced by the bothersome tendency of certain stray fibers to become electrically charged in the proximity of the collecting device, thereby tending to fly back into the field toward the solution feeding device. The occurrence of this phenomenon may be quite troublesome and will seriously interfere with the continuity of operation of the process. Stray fibers which thus fail to attach themselves permanently to the collecting device and tend to fly back into the proximity of the feeding device tend to become attracted and attach themselves to various parts of the solution feeding mechanism, for instance, the spinning nozzles. As the fibers accumulate on and around the spinning nozzle they may amass to a sufficient extent so as to cause serious interference to the free and uninterrupted delivery of spinning solution. In extreme cases they may amass themselves around a spinning nozzle and completely interfere with its satisfactory delivery, thereby necessitating stopping and cleaning of the apparatus.

The above and other difficulties have contributed to the failure to heretofore obtain on a smooth continuous manufacturing basis a continuous, compact, coherent fiber band composed of heterogeneous artificial filaments arranged substantially parallel to each other and being capable, without additional textile operation, of being drawn and twisted into threads or yarns of good quality and strength on standard textile machinery.

In order to overcome the aforesaid difficulties, a method is employed, in accordance with the present invention, which is fundamentally new and which permits the use of simple apparatus similar to the type used in the early days of electrical spinning, when skeins of fiber could not be produced, but only balls of fiber.

In order that the process and apparatus of the present invention be more readily understood, reference is made to the drawings, in which:

Fig. 1 represents a diagrammatic showing of the phenomenon underlying the theory of the invention;

Fig. 2 denotes, in diagrammatic prospective, an alternative system for carrying out the invention;

Fig. 3 shows a further alternative system and

Fig. 4 shows, in part section, a shielding housing which may be employed with either of the systems shown in Figs. 2 and 3.

The physical phenomenon on which the new process is based is shown in Fig. 1. The nozzle 10, preferably negatively charged, delivers a fiber-forming material which, as a result of the force of gravity, tends to fall down vertically. Be-

tween the nozzle 10 and the counter-electrode 11, preferably positively charged, there is a high difference of potential, i. e., a high tension field exists between them, which causes the formation of the fibers. Under the conditions previously employed in the prior art fibers formed from the fiber-forming liquid, after they had left the nozzle were attracted by the counter-electrodes around which they collected in the form of a tangled ball. This invention consists essentially in the discovery that by producing a suitably high field intensity on the counter-electrodes relative to the electrode fixed at the point where the liquid is discharged it is possible, shortly before the fibers reach the counter-electrode, to reverse the attracting power of this counter-electrode into a repelling power, so that the fibers do not collect on the counter-electrodes. In order to produce this reverse effect it is only necessary to produce on the counter-electrode a field intensity of such magnitude as will cause the desired reverse effect. This is accomplished by producing high differences of potential and using a counter-electrode which presents a particularly sharp surface.

The reversal effect upon which the present invention is based cannot yet be explained entirely satisfactorily from a scientific point of view. Very probably, however, it is brought about as follows:

When the single fiber leaves the nozzle 10, as shown in Fig. 1, it is under the influence of gravity and also under the influence of the attraction of the electrode 11, since this electrode is of opposite polarity. The fiber therefore moves towards the sharp tip of the electrode 11, where there is the greatest field intensity. From the tip of the electrode 11 ions move towards the fibers 12. This phenomenon is well known in physics as "electric wind" or "ion wind" (cf. for example R. W. Pohl, "Elektrizitätslehre", Berlin 1931, p. 175). The so-called "ion wind" is characterised by the fact that on the one hand charge-carriers move in a given direction, and that on the other hand molecules of gas are carried along with these charge-carriers, so that a directed stream of gas is produced. This stream of gas endeavors to repel the fibers 12 from the electrode 11. At the same time, the charge-carriers emanating from the electrode 11 neutralise the charge on the fibers 12, and then charge the fibers with the same polarity as that of the electrode 11. The mechanical repulsion effect of the "ion wind" is thus strengthened by the electrical repulsion of the fibers 12 from the electrode 11. Under the influence of the purely mechanical action of the "ion wind", and as a result of the alteration in the charge of the fibers 12, the latter cannot collect upon the electrode 11; they approach to within a certain distance and are then repulsed.

If only one nozzle is used, far too little fiber is produced, and it therefore would be expedient, from an economic standpoint, to use a series of nozzles 10 in a row. It would also be necessary to provide a corresponding row of counter-electrodes 11. With this arrangement, the drum 13 would be very wide, and it would be covered with only a few fibers, which would lead to difficulties. These difficulties could be overcome if the fibers 12 were drawn out of the range of the electric field on a flat surface. A moving band of fibers could thus be formed, opposite to the row of electrodes 10, and as the fibers forming this band have received an opposite charge from the electrodes 11, this band of fibers would be of opposite polarity to those fibers whose charge had not yet been reversed. The band of fibers whose charge had been reversed would attract fibers whose charge had not yet been reversed, and would form a support for them.

From the foregoing it will be seen that it is of advantage to remove continuously the fibers which are first attracted and then repelled by the counter-electrode from the range of the electric field, and in such a way that they form a moving support for other fibers reaching them from the point where the liquid is discharged before their charge has been reversed by the counter-electrode.

In the apparatus for the practical operation of this process which is shown in Figs. 2 and 3, a large number of nozzles is provided and on different sides of each nozzle there are two counter-electrodes each of the same polarity, arranged in such a way as to attract to opposite sides the fibers which are formed from the liquid leaving the nozzles. There is such a high field intensity on the counter-electrodes that the fibers cannot collect on them. Instead of consisting of separate tips, both the counter-electrodes of all the nozzles are formed of conductors so fine that there is a point repulsion effect along them, this effect being sufficiently great to prevent the fibers from collecting on them.

Fig. 2 shows an apparatus in which a number of nozzles 14 are arranged along a straight line. The nozzles 14 which are preferably negatively charged, are fixed on a distributing tube 15, and the fiber-forming liquid, which may be cellulose acetate, flows towards this tube from the storage tank 16 under the influence of the pressure which is produced by compressed gas in vessel 17. The pressure is preferably about 2 atm. Insulated conductors 18 and 19 are arranged below the row of nozzles and parallel to it, on either side of it. The revolving device 20, which guides the fibers and which may, for instance, be in the form of a drum, is arranged in such a way that its direction of revolution is in accordance with the direction of the row of nozzles and that of the conductors 18 and 19.

A high difference of potential is produced between the nozzles 14 and the conductors 18 and 19. An example of a successful difference of potential is about 50 KV. The potential of the nozzles 14 to earth is preferably about 55 KV and that of the conductors 18 and 19 to earth is about 5 KV. Conductors 18 and 19 are of extremely thin wires of metal preferably of the piano wire type.

At first the liquid flows from the nozzles 14 in fine streams, falling vertically towards the earth. At the moment when the difference of potential is produced between the nozzles 14 and the wires 18 and 19, fibers begin to be formed, and streams of fiber are produced, flowing in principle in the direction shown in Fig. 2. Since two wires 18 and 19 are present, two streams of fiber are formed, flowing first towards the wire 18 or 19 respectively, then flowing away from these wires and finally falling towards the ground. The ends of the fiber which reach the ground are raised, for instance by means of a rod made of some insulating material, and placed on the revolving drum 20, which then draws them continuously out of the electric field. This forms a belt of moving fibers which is of the same polarity as the counter-electrodes 18 and 19. This belt of fibers forms a moving support for other fibers which have just been formed but which

have not yet been repelled and had their charge reversed by the wires.

With the processes of the prior art, the distance between the point where the liquid leaves the nozzle and the fiber support always had to be comparatively small. There was therefore always the danger that when the fibers reached the support they would not be dry enough, and that they would stick. This danger does not exist in the process of the present invention. The device 20 which guides the fibers can be placed far enough from the row of nozzles for the fibers to be completely dry when they reach it.

In order to facilitate the conveyance of the fibers to the drum 20, a blast apparatus 21 may be provided to blow them towards this drum. The blast apparatus also helps to prevent the undesirable accumulation of the fibers on the electrodes 18 and 19.

The apparatus shown in Fig. 3 is the same in principle as that shown in Fig. 2, except that the apparatus is curved in shape instead of being modelled on straight lines.

As shown in Fig. 3, a series of nozzles 22 is arranged in a closed curve, for instance in circular form. The nozzles are fixed on to a ring-shaped liquid distributing tube 23, which is connected to the container 24 in which is a fiber-forming liquid, for example acetyl cellulose. The nozzles 22 are under a high potential, so that they form electrodes at the same time. To each nozzle correspond two electrodes, also arranged in closed curves, which are on opposite sides of the curve on which the nozzles are arranged, but approximately concentric with this curve. Both of the electrodes corresponding to each nozzle could be in the form of separate points.

Actually, in the apparatus illustrated in Fig. 3 all the counter-electrodes corresponding to the nozzles are in the form of conductors 25 and 26, curving in the same shape as the tube bearing the nozzles—i.e. in this example circular in form. The connection to the annular electrode 25 is surrounded by an insulator 27, to prevent sparking between it and the tube 23 or the nozzles 22.

After the fibers have passed between the two annular electrodes 25 and 26 which are below the nozzles 22, they are drawn through the device 28, stretched in another apparatus and then spun.

On the device 28 for guiding or drawing off the fibers is formed a tube-shaped fibrous structure, which is very easy to spin.

In the types of apparatus illustrated in Figs. 2 and 3 it is desirable to use as many nozzles as possible and to have them as close together as possible. There is a critical distance, however, determined by experimentation for different sized systems, and the nozzles should not be closer together than this. If they are closer together, the repulsion effect exercised on each other by the fibers formed by various nozzles will become so pronounced that the fibers will not be distributed uniformly over the two counter-electrodes 25 and 26, and part of the nozzles 22 will be supplying only one counter-electrode 25, while another part of the nozzles is supplying only the other counter-electrode 26.

Fig. 4 shows a further modification of the invention employing, in this instance, but a single wire rather than the two wires shown in Figs. 2 and 3. The fiber forming material enters the apparatus through a conduit 29 and is fed to a series of nozzles 30. These nozzles, as in the systems shown in Figs. 2 and 3, constitute the jet electrodes and are preferably negatively charged. A thin wire or knife edge 31 appropriately supported by insulators 32 constitutes the counter-electrode which is preferably positively charged. The formation of fibers 33 is the same as in the systems previously described. An air jet 34 may be employed to facilitate the continuous movement of the fibers from the point of formation to the collecting device 35.

The whole system, including jet electrodes, counter-electrodes, and air blast are preferably enclosed within a housing 36 in order to facilitate recovery of the solvent. Part of the solvent may be condensed and recovered at the bottom of the apparatus while some may be swept by the air current through the air outlet 37, the solvent from this source being condensed in suitable apparatus and used again in the process.

ANTON FORMHALS.

PUBLISHED	A. FORMHALS	Serial No.
APRIL 27, 1943.	METHOD AND APPARATUS FOR SPINNING	225,207
BY A. P. C.	Filed Aug. 16, 1938	

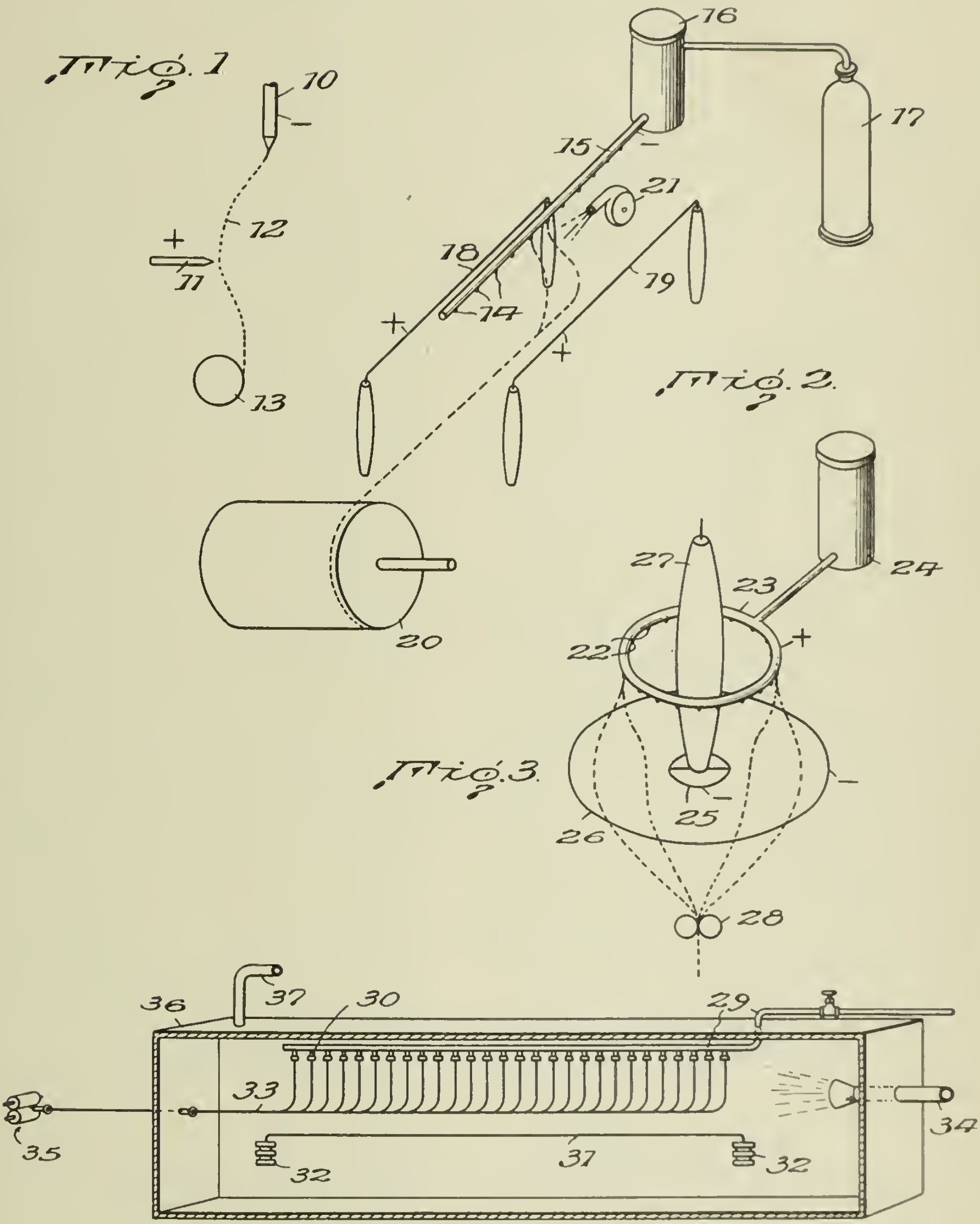


Fig. 4

Inventor

Anton Formhals,

By

Attorney

ALIEN PROPERTY CUSTODIAN

SUSPENSION BRIDGE WITH TORSION-RESISTING STIFFENING SUPPORTING STRUCTURE

Wilhelm Haupt, Dortmund-Hoerde, Germany; vested in the Alien Property Custodian

Application filed September 2, 1938

In patent application Serial No. 126,471 of 18th of February 1937 protection is claimed for bridge supporting structures which in the space between two roadways have a torsion-resisting foot projecting beyond these roadways and which is capable by its torsional strength of taking up the overturning moments imparted by one-sided traffic load. In this patent application a supporting structure for suspension bridges is described, in which the torsion-resisting foot is formed by a torsion-proof stiffening supporting structure. It is absolutely essential, that the stiffening supporting structure is made proof against torsion because the overturning moments occurring in the case of one-sided traffic loading would not otherwise be taken up.

In the suspension bridges hitherto generally known with at least two suspension rod supporting walls between which the main track is arranged, a tension-proof construction of the stiffening supporting structure is not essential because, in the case of one-sided traffic loading, one of the suspension rod supporting walls is merely loaded slightly more than the other suspension rod supporting wall, with the result that the overturning moment is taken up.

However, in this mode of construction the objectionable fact became apparent that the roadway under one-sided traffic loading inclines to a considerable extent in the transverse direction, this transverse inclination attaining under certain circumstances for example the value of 1:30 or even more. It is obvious that such a steep transverse inclination means very great technical disadvantages for high speed traffic, for example high speed electric railways and the like. The extent of this transverse inclination can be considerably reduced if the stiffening supporting structure is made proof against torsion. It is known, that the deformations of a torsion-proof hollow body are exceptionally slight as compared with the saggings of a cable. Therefore, by the torsion-proof construction of the stiffening supporting structure it is possible to attain a transverse inclination of the bridge under one-sided traffic load of only a fraction of the value which occurs when the stiffening supporting structure is not made proof against torsion. The greater the torsional strength of the stiffening supporting structure is made, the more will the one-sided traffic load be relieved on the nearest suspension rods supporting wall and the opposite suspension rods supporting wall is utilized for taking up the vertical load. In the optima case the stiffening supporting structure can be made of such great torsional strength that, if one supporting cable is entirely destroyed, it takes up entirely the strong overturning moments then produced by the continual load. The advantage is enormous, especially in cases of war, as, even in the event of a whole cable being destroyed, the bridge does not collapse (with the result that under certain circumstance the road running under the bridge might also be blocked), but is still even capable of allowing traffic even if on a restricted scale.

The torsional strength of the stiffening supporting structure can be attained in various ways for example

(1) by connecting the upper and lower flanges of each of two vertical stiffening girders by a horizontal connection, it being evident that such a horizontal connection may consist of a solid plate or of a stiff roadway plate,

(2) in that the stiffening supporting structure consists of a three-flange girder or of a tube. As it is known, that the tube cross-section is the most favorable cross-section for taking up torsional stresses, the diameter of this tube can be relatively small and the tube itself can, if desired, be used directly as conduit for gas, water or other fluid. As on the other hand a tube only offers slight resistance to vertical loads, such a construction would offer the advantage of slight transverse inclination even of a suspension bridge unstiffened in the practical sense.

The advantages of a torsion-proof stiffening supporting structure may be ensured even for a supporting structure partly destroyed by bombs, if instead of two vertical stiffening girders more than two such girders are arranged whose upper and lower ribs are connected by horizontal connections. If in such a stiffening supporting structure one or several stiffening girders is or are destroyed by bombs the remaining girders remain torsion-proof with their horizontal connections and are still capable of reducing to a still appreciable extent the transverse inclination of the roadway under one-sided traffic loading.

Several embodiments of the invention are illustrated by way of example in the accompanying drawing in which all Figures show cross-sectional views through suspension bridges.

In the drawings

1 designates a supporting cable,

2 a suspension rod or cable,

3 a vertical stiffening girder which may be constructed as plate girder or a framework girder,

4 an upper horizontal boom,

5 a lower horizontal boom,

6 a transverse girder which may be constructed as a plate girder or as a framework girder,

7 a main track,

8 a footway or auxiliary roadway

9 a stiff roadway plate, for example buckled plate,

10 a secondary longitudinal girder for supporting the roadway plate,

11 a three-flange girder,

12 a destroyed cable,

13 a destroyed vertical stiffening girder,

14 a torsion-proof tube.

WILHELM HAUPT.

PUBLISHED
APRIL 27, 1943.
BY A. P. C.

W. HAUPT
SUSPENSION BRIDGE
Filed Sept. 2, 1938

Serial No.
228,204

Fig. 1

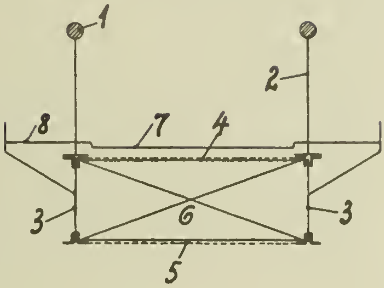


Fig. 2

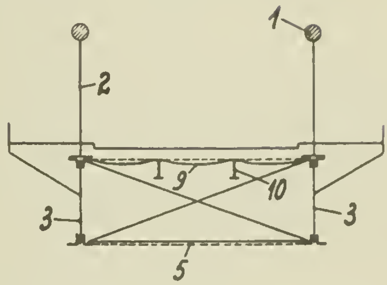


Fig. 3

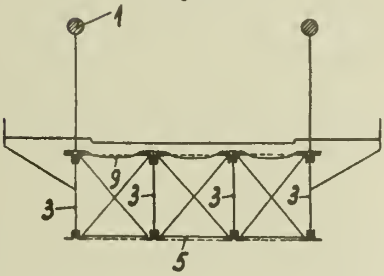


Fig. 4

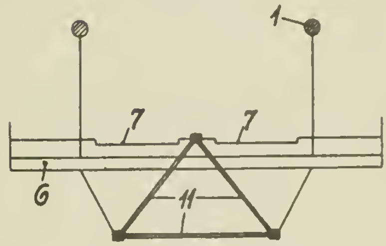


Fig. 5

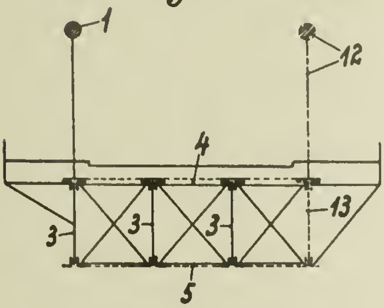
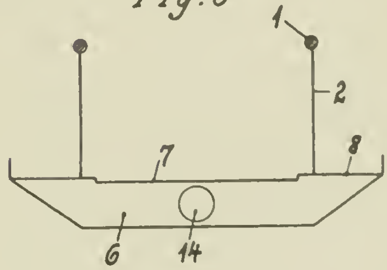


Fig. 6



W. Haupt
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By Glascock Downing & Seebold
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Published Apr. 27, 1943

Serial No. 230,512

ALIEN PROPERTY CUSTODIAN

MOLDING OF MIXTURES OF SOLID AND LIQUID MATTER INTO FILAMENTS

Otto Roelen, Oberhausen-Holten, Germany; vested in the Alien Property Custodian

Application filed September 17, 1938

This invention relates to the treatment of mixtures of solid and liquid matter for the purpose of molding such mixtures to form thin filaments or threads. It is particularly concerned with the molding of masses containing solid matter, for instance a precipitate, suspended in water, such as the mixtures of inorganic compounds with a carrier substance used in the preparation of catalysts.

Thus for instance catalysts adapted for use in the synthetical production of benzines from carbon monoxide and hydrogen are prepared by precipitating metal salt solutions, for instance a solution of cobalt nitrate and thorium nitrate with an alkali metal carbonate in the presence of kieselguhr. When the alkaline liquor has been separated by filtration, the solid matter is still imbibed with 70–80% water. In spite of this high water content the filter cake has a great consistency and it is impossible to mold it into thin filaments, for instance of 1–3 mms. diameter, with the aid of the methods hitherto used for this purpose.

As is well known to those skilled in the art, masses, which could be kneaded, have been molded into filaments or threads by means of hydraulic presses, in which the mass is extruded by means of a piston through the perforated press bottom. Instead of a press operated with a piston also a worm or gear press has been used for this purpose. I have found that it is very difficult to mold, after one of the methods described above, masses which in spite of a comparatively high content of liquid lack a paste-like consistency. Such masses cannot be extruded from a piston-, gear- or worm-press, since under the influence of the pressure the mass is decomposed, the liquid escaping through the perforations, while the solid matter remains on the perforated bottom and soon clogs the perforations.

I have now found that it is possible to extrude also such masses containing a high percentage of liquid with the aid of the types of presses mentioned above and to form them into thin filaments or threads, for instance of 1–3 mms. diameter, provided that the mass, before being forced through the perforations, is subjected to a slight mechanical treatment whereby the mass, which in spite of its high liquid content possesses a high degree of coherence and stiffness, is reduced to the consistency of a paste. I have found that in this state the mass can easily be extruded through the perforations and formed into thin filaments or threads.

It is essential that the mechanical treatment of the mass be carried through to a predetermined extent only, for if the treatment of the mass is conducted beyond a certain point, the mass becomes thinly fluid and then drips through the perforated bottom without forming coherent threads or filaments. On the other hand, if the mechanical treatment is insufficient, the mass separates into water and solid matter and the narrow perforations are clogged.

The extent of mechanical treatment of the mass depends on the kind of material to be treated and can easily be ascertained by tests, it being merely essential that the mechanical treatment reduce the mass to a pastelike or doughy consistency.

In the drawings affixed to this specification and forming part thereof several embodiments of a device, in which such masses can be subjected to the mechanical treatment enabling them to be molded into filaments or threads, are illustrated diagrammatically by way of example.

In the drawings

Fig. 1 is a diagrammatic showing of the perforated bottom of an extruding press in combination with means for treating the mass covering this bottom.

Fig. 2 is a diagrammatic sectional view of a press fitted with a perforated bottom such as shown in Fig. 1.

Fig. 3 is a plan view of this bottom and the mechanism for treating the mass deposited thereon.

Figs. 4, 5 and 6 are diagrammatic views of perforated press bottoms in combination with modified forms of the mechanical means for reducing the mass deposited on these bottoms to a paste.

Figs. 7 and 8 are a vertical axial section and a vertical cross section, respectively, of another extruding apparatus, in which a rotary element serves for mechanically treating the mass to be extruded.

Figs. 9 and 10 are diagrammatic cross sections of two modifications of the device shown in Figs. 7 and 8.

Referring to the drawings and first to Figs. 1–3, **1** is the vertical rectangular shaft of a press and **2** is a piston vertically reciprocable in this shaft. **3**,**3** are inserts of triangular section resting on the bottom **4** and covering the unperforated parts of the bottom, leaving only the middle section uncovered, which is formed with some parallel rows of perforations **5**. **6**,**6** are horizontal stuffing boxes extending across the wall of the shaft **1** and the inserts **3**, and **7** is a connecting rod governing the reciprocating movements of a pair of parallel

rods 8 extending through the stuffing boxes 6 and carrying a rod 9, which rests on the perforated bottom 4, extending in parallel to the rows of perforations 5. 10 is an eccentric disc governing the movements of the rods 7 and 8, which is driven by means of a belt 11 from a shaft 12.

The mass to be molded into thin threads or filaments, for instance a mixture consisting of 5–10% metal carbonate, 10–15% kieselguhr and 80% water, which fills the shaft 1, is forced by the piston 2 with a pressure of 0.1–0.2 kg/cm^2 into the bottom part of the shaft. The rod 9 being reciprocated across the rows of perforations 5 at the rate of about 70 strokes per minute effects a kneading treatment of the mass, whereby this mass is reduced to a kind of paste, which is then forced by the slight pressure exerted upon it and by the action of the reciprocating rod 9 through the perforations 5, issuing under the form of thin filaments, which, on being dried and comminuted, form small uniform pencils.

In contrast to the known extruding pressures a device such as here described enables great quantities of such a mass to be molded into filaments at the rate of 0.2–1 m per second.

In view of the far reaching subdivision of the mass into thin filaments or threads the efficiency of the catalyst is greatly increased owing to its large surface action. This subdivision of the mass into threadlike skeans offers the further advantage that the mass need not be comminuted after the drying, since the thin threads on dropping onto a table break up into small pieces.

Instead of a straight rod such as 9 a grid structure such as shown in Fig. 4 may be used. Here a grid formed of two parallel bars 13 and cross bars 14 is designed to be reciprocated in the longitudinal direction of the rows of perforations 5.

Fig. 5 illustrates the use of an undulated distributed device 15. In Fig. 6 the reciprocatory distributing device 16 has zig-zag shape.

In the modified form of a distributing and extruding device shown in Figs. 7 and 8, 17 is a hopper and 18 a semicylindrical bottom, the middle section of which is formed with parallel rows of perforations 19. 20 is a cylinder supported in bearings 21 and rotated by means of a pulley 22 and belt 23 from a suitable motor (not shown). 24 are radial vanes fixed on the cylinder 20, the outer edges of which, when the cylinder is rotated, sweep the surface of the perforated bottom 18.

Here the vanes 24 are relied upon to subdivide the mass to be extruded, so as to reduce it to a paste capable of passing through the perforations 19 in the form of coherent filaments or threads.

In the modified form shown in Fig. 9 vanes 25 are mounted tangentially on a rotor 26 of hexagonal cross section. The action of these vanes is substantially the same as that of the vanes 24 described with reference to Figs. 7 and 8.

Fig. 10 illustrates a further modification, in which 27 is a hopper closed by a plane perforated bottom 28, above which is mounted for rotation about an axle 29 a fluted cylinder 30.

If this cylinder is rotated at high speed, it will exert a similar action on the mixture of solids and a liquid as the rotors shown in Figs. 7–9.

Obviously the material to be subjected to the comminuting and extruding treatment may also be fed through the shaft or hopper by means of a gear pump, a conveyer worm or the like replacing the piston 2 shown in Fig. 2.

Various changes may be made in the details disclosed in the foregoing specification without departing from the invention or sacrificing the advantages thereof.

OTTO ROELEN.

PUBLISHED

APRIL 27, 1943.

BY A. P. C.

O. ROELEN

APPARATUS FOR FORMING THREADS OR FILAMENTS FROM MIXTURES OF SOLID AND LIQUID MATTER

Filed Sept. 17, 1938

Serial No. 230,512

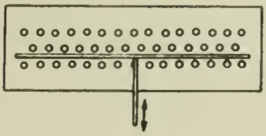


FIG. 1.

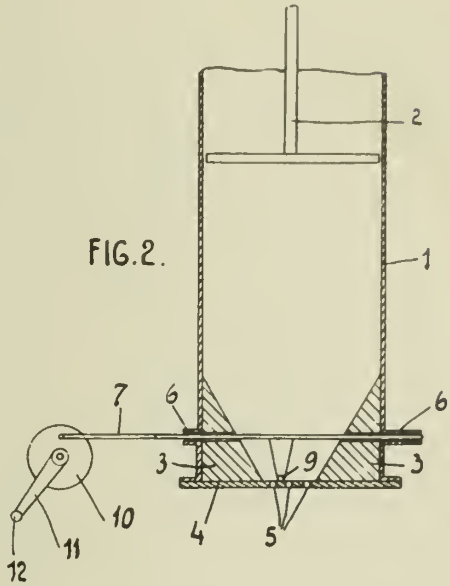


FIG. 2.

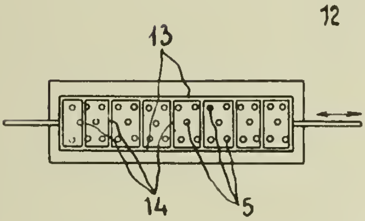


FIG. 4.

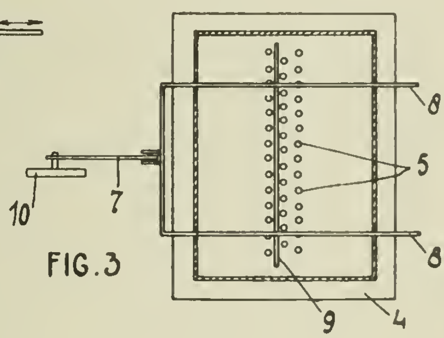


FIG. 3

FIG. 5.

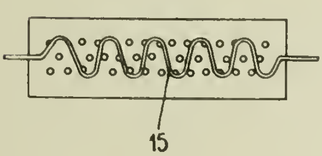
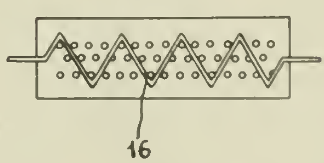


FIG. 6.



Inventor
Otto Roelen
by [illegible], atty.

Published Apr. 27, 1943

Serial No. 233,688

ALIEN PROPERTY CUSTODIAN

POLARIZING BODIES

Erwin Käsemann, Klein-Maehnow bei Berlin, Germany; vested in the Alien Property Custodian

No Drawing. Application filed October 6, 1938

This invention relates to polarizing bodies which can be used as slip-on filters for the projection of and as polarizing spectacles for the viewing of stereoscopic films, as devices for avoiding glare from automobile head lights, as photographic filters, and for similar purposes.

In my copending application Serial No. 154,204 of July 17, 1937, I have described polarizing bodies which consist of coloured foils of colloids, such as cellulose hydrate, the said foils having been subjected to a strong mechanical stretch. It is an object of the present invention further to improve the polarizing bodies disclosed in that specification.

It has now been found that filters exhibiting particularly good polarisation can be obtained by using coloured foils of colloids such as cellulose hydrate, the production of said foils being effected in such a manner that the band obtained on pouring out viscose is first partly coagulated, preferably in a neutral salt solution, then stretched mechanically, and finally subjected to complete coagulation. Viscose can be poured on to a support, such as a drum. The support can, however, be dispensed with, for example, by extruding viscose directly into the coagulation bath. The neutral salt solution may consist, for example, of an ammonium sulfate solution. By undergoing partial coagulation in this bath the viscose band is solidified to a considerable extent; it can now be removed from the base and subjected to particularly vigorous stretching. Preferably the stretching is discontinued just before the breaking point is reached. Then, the coagulation of the band which is being maintained in a stretched condition is completed in an acid bath, and further treatment and dyeing is effected in the manner familiar from the production of coloured cellulose hydrate foils. This further treatment need not necessarily be carried out while the band is in a stretched condition, since after the complete coagulation is finished the individual particles of the colloidal material of the foil are structurally fixed to a large extent.

The foils produced and stretched according to the invention have been found to take up the dye or dyes present in the dyeing solution considerably slower than do foils produced according to usual methods. Whereas ordinary foils are strongly dyed within a few seconds, the dyeing of the foils according to the invention requires up to an hour and more. Hence, it is preferred to use higher bath temperatures, sometimes boiling temperatures.

It has been found that foils with particularly good polarisation are obtained when the manufacturing and stretching process of the new foils is carried out in such a manner that the finished coloured foil undergoes a shrinkage in width amounting to one fourth to one sixth or more of the original width. Even when the shrinkage in width has not been pushed so far, useful foils are obtained. The abovementioned shrinkage in width is achieved essentially by strong mechanical stretching. The result aimed at is favoured by using as raw material cellulose with a particularly high percentage of α-cellulose (say 90 to 94 per cent), or cellulose made from cotton linters. The mode of preparation of the viscose is also essential in producing sufficient shrinkage in width. Thus, it has been found that viscose, after being subjected to a two days' preliminary maturing process at 20°C and to a subsequent maturing process at a salt value of about 2 to 3, on partial coagulation in a neutral salt solution yields a foil exhibiting a micelle structure that is especially suitable for the subsequent stretching operation and the desired shrinkage in width.

Cellulose hydrate foils produced according to the cuprammonium process can likewise be used for the manufacture of the new filters. Here again, stretching is carried out prior to the final step of complete coagulation.

Dyes belonging to the most varied classes can be employed for dyeing the colloid foils. Particularly suitable are dyes which dye cotton direct. As examples may be named benzidine dyes such as Diamine Blue, Oxamine Green G, Diamine Fast Red, etc. The light-resisting substantive dyes known under the trade name of Sirius dyes have proved especially useful.

The dyeing of the foils is carried out in accordance with the known methods of dyeing cellulose hydrate foils, preferably after the foils have left the last of the usual baths employed in their production, said bath being, as a rule, an aqueous bath.

When dyeing foils with certain dyes and using these coloured foils as polarizing bodies, not the whole visible spectrum of light will be polarized. This will result in the colour of the foil not being extinguished in the analyzer. In order to extinguish the whole visible spectrum, two or more foils of different colours can be superimposed for the production of the new polarizing bodies, said colours being complementary so as to give, by substraction, a homogeneous grey. Care must then be taken that the polarizing axes of the individual foils are parallel.

In lieu of superimposing several foils having different colours, foils dyed with black dyes may also be used. Substantive black dyes, as a rule, consist of mixed dyes, the single components being taken up very differently by the extremely stretched foil material according to the invention. Hence, it is preferred to apply the individual dyes that are necessary for producing a homogeneous grey, in a succession of separate baths. In this manner, particularly when the progress of the dyeing operation is watched colorimetrically, it is assured that of every single component there is taken up the amount necessary to produce a homogeneous grey, said grey exhibiting uniform absorption over the whole range of the spectrum.

The quantity of the dyes employed is adjusted according to the amount of residual light allowed with crossed polarizing bodies formed by using the new foils. The greater the amount of residual light to be allowed, the smaller the quantity of colouring matter employed for dyeing the foils. With foils intended for eliminating glare from automobile head lights, a greater amount of residual light may generally be allowed than with foils to be used in the manufacture of polarizing spectacles for viewing stereoscopic motion pictures.

After the dyeing operation is finished the foils, preferably in stretched condition, are subjected to drying while being continuously moved in order to effect uniform shrinkage in width. If the foil is available as an endless band it can be moved, for example, by the pair of rollers used in the production of an endless band, as mentioned below.

Further it has been found that particularly effective polarizing bodies consisting of cellulose hydrate foils which, at any stage of the manufacturing process or during the whole of the manufacturing process, have been subjected to a strong mechanical stretch, can be obtained by dyeing said foils with iodine.

It is particularly advantageous to effect the dyeing of the foils by treating them with hydroiodic acid. Both commercial concentrated hydroiodic acid (sp. gr. 1.7) and more or less diluted aqueous solutions of hydroiodic acid are suitable. The cellulose hydrate foils which have been mechanically strongly stretched during their manufacture, are preferably dried and then immersed in an aqueous solution of hydroiodic acid. Depending on the duration of the treatment, the coloration of the foils which is thus obtained, is a more or less homogeneous grey. Preferably the foils are dyed so strongly that they exhibit a transparency of 20 to 50 per cent. With a treatment ranging from half a minute to a few minutes there are obtained polarizing foils which, when crossed, transmit an extremely low amount of residual light.

In lieu of concentrated or aqueous solutions of hydroiodic acid, gaseous hydrogen iodide can be employed for dyeing the foils, the vapour of hydrogen iodide being preferably caused to act upon the damp foils which have previously been strongly stretched. Other inorganic or organic compounds than hydroiodic acid, which are able to split off hydrogen iodide, may be used for dyeing.

It is to be noted that cellulose hydrate foils treated with hydroiodic acid exhibit a particularly strong shrinkage in width in the direction at right angles to that of the oriented individual colloid particles of the cellulose hydrate foils. A narrow double lattice is thus formed which, on the one hand, consists of the oriented, more or less transparent individual colloid particles of the cellulose hydrate foils and, on the other hand, of opaque dye particles formed by the iodine obtained from the hydroiodic acid.

It may be advantageous, during or after the treatment of the cellulose hydrate foils with hydroiodic acid, to cause mild oxidizing agents such as quinone, ferric salts, or the like, to act upon the foils.

Since iodine is volatile to a certain extent, it is preferred, after the treatment with hydroiodic acid, to coat the foils with a protective layer which renders them non-porous. As materials which have proved suitable, cellulose nitrate, cellulose acetate, celluloid, colourless synthetic resins, and similar substances, may be named. The foils treated with hydroiodic acid, after the latter has taken effect, are soaked in water for a short time, dried, and immersed in solutions of the abovementioned materials in organic solvents, such as solutions of cellulose nitrate in acetone, amyl acetate, or the like, or sprinkled with the said solutions.

The coating of the cellulose hydrate foils with protective layers which render the foils non-porous, is to be preferred not only with foils dyed by means of hydroiodic acid, but also quite generally with foils that have been dyed with inorganic or organic dyes exhibiting a certain volatility.

It has been known to impart dichroitic properties to certain colloidal organic substances by dyeing them with zinc chloride iodine solution. Apart from the fact that, on the basis of this observation, the manufacture of polarizing bodies suitable for technical purposes was not rendered possible, the polarizing properties of cellulose hydrate foils dyed by means of hydroiodic acid are considerably superior to those of foils dyed with zinc chloride iodine solution.

Polarizing bodies having particularly valuable polarizing properties and an especially high transparency can be obtained by dyeing, substantially, only the surface layers of the foils. In order to achieve the said dyeing of the surface, care must be taken to prevent the foils from swelling during the dyeing operation; similarly, foils which are strongly swollen should not be used for dyeing. Hence, during the dyeing of the foils and the operations immediately preceding the dyeing, the addition of swelling agents, such as alkalis or other substances or salts having an alkaline reaction, should be avoided. Furthermore, it is an advantage to subject the foils immediately prior to or, if desired, during the dyeing operation to a treatment with astringents such as strong acids, e. g., hydroiodic acid, acid metal salts, e. g., alums, tannin, formaldehyde, or the like. Since foils which have been mechanically strongly stretched, show less tendency to swell than do normal foils, it is preferred to carry out the dyeing not till after the stretching has been effected. By means of microtomical sections it can be readily ascertained how deep the dye from the surface has penetrated into the foil. By following the directions given above, while adjusting the length of the treatment, the concentration of the dyes, and the temperature of the baths, a coloration can be obtained which is substantially limited to the surface.

Other substances than the dyes mentioned above, such as iodine, selenium, bismuth, tellurium, etc., can be employed for dyeing the foils.

In contradistinction to the customary methods

of dyeing with substantive dyes, these dyes are applied without the addition of swelling agents, particularly of salts.

The dyeing with iodine, as described above, is carried out by using hydroiodic acid, while the dyeing with metals or metalloids, respectively, such as bismuth, selenium, tellurium, is effected by reduction of their oxyacids by means of hydrazine hydrate or its salts. It is essential to employ these acids at a high concentration and to allow them to act only shortly on the foils to be dyed. If, when using the acids at a high concentration, e. g., at a concentration nearing saturation, the said acids are not taken up in sufficient quantity, it is prefered to cause the foils to swell slightly by immersing them in water. The addition of swelling agents having an alkaline reaction should, however, be avoided. The slightly swollen foils are then immersed in the concentrated acid solutions which results in the acids penetrating substantially by diffusion, while the depth of penetration is determined by the time required for diffusion. It is not till then that the foils are transferred into the solutions containing the reducing agents, when the colouring substances are precipitated.

In the production of the polarizing bodies according to the invention it has become apparent that foils made in the shape of an endless band can be stretched to a particularly high degree, the risk of breaking being smaller than in the case of bands in long lengths. The endless band is formed by pouring viscose on to the surface of a drum. The drum carrying the viscose is then transferred into a neutral salt solution, whereupon the partly coagulated viscose layer is detached from the drum and placed round two rollers which rotate in the same direction and whose distance, by means of a stretching device, can be continuously increased. The stretching of the foil is then effected by operating the stretching device. Further particulars of the manufacture of the endless band are disclosed in my copending application Serial No. 154,204.

Other colloidal organic substances than cellulose hydrate, whose molecules or micelles are oriented and which show optical properties similar to those of cellulose hydrate foils, i. e., act as uniaxial crystals and rotate the plane of polarized light, can be used for the production of the new polarizing bodies. For example, as further colloidal substances there may be mentioned cellulose esters, particularly cellulose acetate. With these substances, there is first produced, by thermal or chemical means, a certain preliminary solidification of the poured or extruded foils which are then subjected to mechanical stretching, whereupon final solidification is effected.

It is preferred to employ, for the improved polarizing bodies according to the invention, foils of a thickness of <0.02 mm. Foils having a thickness of 0.005 mm have proved particularly advantageous. For this purpose, viscose is poured on to a support in a thickness of 0.25 to 0.3 mm.

The polarizing foils according to the invention, after having been coated with a protective layer, preferably after a layer of Canada balsam or a similar material has been applied to the foils, are enclosed between protective glass plates. It is preferred to employ glass having a high absorption capacity for rays of short wave length, i. e., ultraviolet rays, for example, lead glass.

The polarizing bodies according to the invention exhibit particularly desirable polarizing properties. They are optically completely homogeneous and show neither streaks nor stains.

ERWIN KÄSEMANN.

Published Apr. 27, 1943 Serial No. 234,900

ALIEN PROPERTY CUSTODIAN

NETS, ROPES, SAILS AND OTHER ARTICLES FOR FISHING AND SEA-FARING USE

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No Drawing. Application filed October 14, 1938

Nets, ropes, cords, sails and other articles of fibrous material which are used in fishing and sea-faring have hitherto been made almost exclusively from cellulose fibers, for instance cotton, flax, hemp or jute. It is known that such articles rapidly deteriorate because cellulose fibers in moist condition are easily attacked by bacteria which degrade the cellulose. Thus the fibers become weakened and the articles made therefrom, such as nets or cords, very soon become useless for the fisherman. It is, therefore, generally customary to impregnate the aforesaid articles with copper soaps, tar, tanning agents or like bactericides in order to prevent the attack of bacteria. However, the protective effect of this impregnation is of short duration because on the one hand it is very difficult to completely saturate the fibers and on the other hand the impregnating agent is very soon washed out by water in use.

This invention relates to the manufacture of nets, cords and other articles which are to be exposed to moisture and seawater from fibers and threads of synthetic resins, especially those obtainable from compounds containing halogen, for instance polyvinyl chloride and afterchlorinated polyvinyl chloride, it having been found that such material is almost ideal for the purpose. The synthetic vinyl resins are practically unattacked by bacteria. The fibers or threads obtained therefrom are also sufficiently strong for use in lieu of the materials hitherto used. Even when they have lain in water or soil for weeks or months, the fibers and threads from synthetic vinyl resins are scarcely affected in their strength. At the same time they do not swell in water and are quite stable against seawater and other chemical agents.

Besides the above-named halogen-compounds among which chlorinated rubber is to be included fibers made from polymerized hydrocarbons as well as mixed polymerizates of hydrocarbons or halogen hydrocarbons with other unsaturated compounds, for instance acrylnitrile, acrylic acid esters, vinyl esters may be used, the proportions of which in halogen hydrocarbons or hydrocarbons on the one hand and the other unsaturated compounds on the other hand may vary between wide limits. Moreover, the number of these compounds to be used in combination is not limited to those named above but includes all substances which can form mixed polymerizates with unsaturated hydrocarbons or halogen hydrocarbons. It is merely necessary that in each case a test should be made to ascertain the correct admixture for obtaining the desired mechanical strength and stability to bacteria and rotting.

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Published Apr. 27, 1943 Serial No. 235,842

ALIEN PROPERTY CUSTODIAN

WOODEN FRAME TRUSSES

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Application filed October 19, 1938

This invention relates to frame trusses of box or I-cross-section in which the webs consist of plywood and the flanges of rectangular timber, all the parts being secured together by means of artificial resin glue. It thus relates to wooden solid wall frame trusses which are extremely well adapted to the nature of the material.

The invention deals with the problem of satisfactorily transmitting by simple means the forces arising at the structural and assembly junctions. According to the invention this problem is solved by a joint covering plate having the full height of the girder being glued in at each corner of the frame in a suitable depression in the rectangular timber flange. This joint covering plate transmits not only the forces in the web but also the forces in the flanges. The said plate can be adapted to the contour of the upper end of the truss upright. In frame trusses of I-cross-section however the joint covering plate or each of the plates arranged on both sides of the web is preferably so constructed as to project over the inner corner of the frame. At this projecting part of the plate by means of lining pieces the checks of stiffening tongues are secured which extend over the outer side of the flanges and so far over the outer frame corner that the ends of the cheeks projecting beyond the outer frame corner can be connected with the wall uprights of the construction.

In frame trusses of I-cross-section in which the cross member is carried through to the outer edge of the frame and rests upon the upper end of the truss upright the joint covering plate is so arranged that it bears upon the outer flange of the upright and extends downwardly from the upper edge of the cross member. The plate in this case has the same breadth as the outer flange of the upright. The bearing formed by the lower side of the lower flange and the lower edge of the web of the cross member is in this case glued to the end surface of the upright which carries it. It is advisable to insert on each side a plywood plate in the corner enclosed by the flanges of the upright and the flanges of the cross member and to glue it to the web plate of the cross member. The abutting ends of the flanges according to a further feature of the invention are sharpened towards the truss web and the spaces formed in this way are filled by wooden wedges glued in.

The invention makes possible the construction of frame trusses of box or I-cross-section, the continuous webs of which consist of plywood while the flanges consist of rectangular timber, all parts being secured together by glueing. The frame trusses constructed according to the invention have a very great strength and are suitable for large spans. The external appearance of these trusses is exactly the same as that of the known welded steel frame trusses.

Some constructional examples of the invention are illustrated in the acommpanying drawings.

Fig. 1 shows diagrammatically the profile of a continuous wall frame truss.

Fig. 2 shows on a larger scale the left-hand truss upright and the jointing part of the cross member. The frame corner is fitted with the joint covering plate according to the invention.

Fig. 3 is an elevation from below of the foot of the truss.

Fig. 4 is a side elevation of the truss foot according to Fig. 3.

Fig. 5 is a plan view of the truss upright in section on line V—V.

Fig. 6 is an end elevation of the cross member in section on the line VI—VI of Fig. 2.

Fig. 7 shows the truss corner before the application of the plywood plates on the same scale as in Fig. 2.

Fig. 8 shows the same frame corner as in Fig. 7 after the application of the joint covering plate.

Fig. 9 shows in elevation the truss upright and the parts of the cross member belonging to the frame corner of a frame truss according to the invention with I-cross-section.

Fig. 10 is a side elevation in section on the line X—X in Fig. 9.

In Figs. 11 to 14 a second constructional form of the truss with I-cross-section according to the invention is illustrated.

Fig. 11 is an elevation of the truss corner,

Fig. 12 is a section through the upright on the line XII—XII in Fig. 11.

Fig. 13 is a section on the line XIII—XIII of Fig. 11.

Fig. 14 a section on the line XIV—XIV in Fig. 11 and

Figs. 15 to 23 show another constructional form of the frame corner according to the invention.

Fig. 15 shows the corner of the truss in elevation.

Fig. 16 shows the same corner but without web plates.

Figs. 17 to 20 are cross-sections on the correspondingly numbered section lines in Fig. 15.

Fig. 21 is a cross-section on the line XXI—XXI of Fig. 16.

Fig. 22 shows one of the additional power transmitting plates which are provided in the frame corner according to Fig. 15.

Fig. 23 is an outside elevation of the upper end of the truss upright.

Fig. 24 shows in elevation the assembly junction of the truss cross member.

Fig. 25 is a plan of the assembly junction shown in Fig. 24 without the upper flange plate.

Fig. 26 is a cross-section through the joint of the assembly junction according to Fig. 24.

Fig. 27 shows in elevation an assembly junction for connecting the two halves of the truss cross member.

Fig. 28 is a plan of the assembly junction shown in Fig. 27 without the upper flange plate.

Fig. 29 is a section through the joint in the assembly junction according to Fig. 27.

The truss upright consists of the two rectangular timber flanges **20** and **21** which at their foot ends are connected together by means of a glued in wooden wedge piece **22** and hard wood dowel **23**. The foot covering consists of a Z-shaped metal member **24** which is secured in the foot by means of screw bolts **25**. By means of the covering **24** the foot of the truss upright rests upon the bearing timber **26** as shown in Fig. 4. **27** is the longitudinal sill which rests on the heads of the bearing timbers. About halfway up between the rectangular timbers **20** and **21** a rectangular timber member **28** is inserted. This member **28** is firmly secured to the two flanges both by glueing and by nailing. **29** and **30** are the flanges of the truss cross member which also consists of rectangular timber. The flange **21** of the upright is extended beyond the flange **30** of the cross member and is tenon jointed to the upper member **29** (reference numeral **31**). At the point of intersection the flanges **21** and **30** are interleaved with one another. The flange **30** is extended up to the inner side of the flange **20** of the truss web while the upper end of the flange **20** is tenon jointed to the left-hand end of the flange **29** at **32**. The space in the corner enclosed by the flanges **20**, **21**, **29** and **30** is completely filled by means of three pieces of rectangular timber **33**, **34** and **35** and a hard wood cleat **36**. The pieces of rectangular timber are glued together and to the flanges. The bolts **37** serve for connecting the hard wood cleat with the flanges **20** and **29** during the assembly of the truss. When left in the truss they increase the strength and stiffness of the corner. **38** is a wall frame which together with the bearing sill serves for securing the wall plates which are not illustrated. Fig. 7 shows the arrangement described before glueing on the plywood plates. The flanges **20** and **21** are provided on each side with a recess which begins at the point **39** and extends to the upper edge of the flange **29**. The flange **29** is also provided with a corresponding recess, the right-hand end of which is indicated by the line **40**. In this recess on each side of the truss there is inserted firstly a joint covering plate **41** of plywood as shown in Fig. 8. This plate is secured to the surface of the rectangular timbers which it touches by means of glue, preferably artificial resin glue. It serves for transmitting the forces from the truss upright to the cross member and vice versa and bridges over the joint at the corner of the plywood web plates **42** and **43**. This joint is indicated in Fig. 2 by the reference **44**; at this point the abutting plywood plates **42** and **43** are glued together. The flanges **20** and **21** are also covered by means of the plywood plates **42**. Since the plywood plate **42** is secured to these rectangular timbers by glueing on all surfaces where it touches the flanges there is obtained a girder of box form cross-section consisting entirely of wood. The same applies to the truss upright which consists of a girder with box form cross-section, the web being formed by the two plywood plates **43** and the flanges by the two rectangular timbers **29** and **30**. As is clear from Fig. 6 the arrangement is made such that a part of the flange **29** projects over the upper edge of the plywood web **43**. The upper side of the flange **29** is provided with two longitudinal grooves **45** running in the same direction which are used in securing the plates employed for covering the roof. Fig. 5 shows that the flange **20** of the upright is also provided with a part **20***a* projecting over the outer edge of the web **42** which also has two grooves or channels **20***b* running in the same direction. In the vicinity of the joint covering plate **41** the outer wall of each groove **20***b* is formed from the correspondingly projecting edge of the plate **41**. This arrangement is made for securing the wall plates which are not illustrated.

The constructional example illustrated in Figs. 9 and 10 relates to a continuous wall truss of I-cross-section. The upright consists of a plywood web **75** which extends from the line **76** up to the lower side of the flange of the cross member. Parallel to the right and left edges of the web **75** the flanges made of rectangular timber **77** and **78** are glued on at each side of the web. These flanges extend from the line **76** up to the lower side of the upper flanges of the cross member consisting of rectangular timbers **79** and at the places where they intersect the lower flanges of the cross member consisting of rectangular timbers **80** are interleaved therewith. Each of the two flanges **78** is provided at its upper end with a recess beginning at the line **81** and extending up to the end of the flange. A wooden plate **82** is glued into this recess by means of artificial resin glue which plate bridges over the joint at the inner corner of the frame. **83**, **84** and **85** are rectangular timbers which are glued into the space formed between the opposite surfaces of the flanges **77** and **78** and the web **75** for the purpose of stiffening. The stiffening **85** is moreover interleaved with the flanges **77** and **78**. Moreover in the space bounded by the flanges **77**, **78**, **79** and **80** on each side of the plywood web **86** of the cross member a plywood plate **87** is inserted and is secured to the surfaces which it touches by glueing.

The joint covering plate in this construction of the truss according to the invention is arranged on the outside. It consists of a plywood plate **88** which is placed and glued in a recess in the flanges **77**. The plate **88** extends from the upper corner of the truss up to the point **89**; it may however be shorter.

At the lower end of the truss upright a foot in the form of a sheet iron plate **90** bent into a U-shape is secured by means of screw bolts **91**. By means of this foot **90** the upright is secured to the concrete foundation **92**.

Figs. 11 to 14 show another constructional form for a truss of I-cross-section. The foot consists of the plywood web **95** and the flanges each made of two glued-on rectangular timbers **96**, **97**. The web **95** extends from the foot which is not illustrated up to the joint **98** while the flanges **96** and **97** end at the points **96***a*, **97***a*. At these points suitable rectangular timber members **100**, **101** are

applied and glued on, which extend in the direction of the flanges 102, 103 of the cross member. The members 100, 101 are glued on to a plywood web 99 in exactly the same way as flanges 96 and 97 and like this web end at the line 104. This line is the joint between the upright and the cross member. The plywood web 99 extends from the line 104 up to the left-hand edge of the flange 96. At the line 98 the lower end of the plywood plate 99 abuts against the upper edge of the plate 95. The joint is effected by means of artificial resin glue and is bridged over by a joint covering plate 105 also consisting of plywood. Such a joint covering plate as shown in Fig. 13 is arranged on each side of the plywood web 95, 99 of the upright. Each joint covering plate 105 extends from the line 105*a* to the line 105*b*. The inner edge of the joint covering plate however does not follow the line of the inner edges of the flanges 97 and 101 but extends beyond the inner corner of the truss. The inner corner of each joint covering plate 105 thus does not follow the line 106. On the parts of the joint covering plate projecting over the inner corner of the frame rectangular lining members 107 are glued; moreover the space between the two projecting parts of the two joint covering plates is filled by an inserted triangular plate 108. All the parts are connected together by means of artificial resin glue. The timbers 96, 97, 100 and 101 are provided with suitable recesses where they meet the joint covering plates. The frame corner is stiffened by means of nippers the cheeks of which consist of wooden plates 109. The wooden plates are bolted to linings 107 and the ends of the two joint covering plates which project over the inner frame corner and extend beyond the outer side of the flanges. They extend beyond the outer corner of the frame and are bolted to the wall uprights 110. At the joints 104 the rectangular timbers 100, 101, 102 and 103 are sharpened as shown in Fig. 12. Fig. 12 shows a plan view in section on the line XIV—XIV of Fig. 11. On account of this sharpening of the timbers wedge-shaped spaces are formed in which suitable wooden wedges 111 are inserted. The wedges 111 project over the joints and are bolted to the flanges. The joints between the plywood web plate 112 of the cross member and the plywood plate 99 is bridged over by a wooden plate 113, such a plate being provided on each side of the joint. Moreover wooden plates 114 are provided which are bolted together.

All the connections between the individual components are effected by glue joints with artificial resin glue or an equivalent glue with the exception of those which are specifically stated to be bolted joints.

The construction illustrated in Figs. 15 to 23 relates to a frame truss of box cross-section in which the webs consist of plywood and the flanges of rectangular timber each frame corner being provided with a joint covering plate which transmits not only the forces in the webs but also the forces which arise in the flanges. In addition to the two joint covering plates arranged on the outside of the frame corner in this constructional example a number of plywood plates (or only one plywood plate) are arranged in the interior of the box girder which also take part in the transmission of force. This has the result that the tension is more uniformly distributed over the whole cross-section of the girder so that it is possible to make the span of such trusses very great. The upright like the cross member is constructed as a box girder. Each girder consists of four flanges, two webs and two plates made preferably of surfaces of the flanges which extend transversely to the webs.

In Figs. 15 to 23 200 are the outer flanges of the upright and 210 are the two inner flanges of the upright. 220 are the web plates of plywood glued on to the outside of the said flanges which are extended up to the line 230 indicated in Fig. 15. The flanges 200 and 210 of the upright extend higher up and are interleaved with the corresponding flanges of the cross member. The cross-member consists of the two upper flanges 240, the two lower flanges 250 and the two web plates 260 of plywood. On the outer surfaces of the flanges 240 and 250 extending transversely to the web plates 260 these plates 270 are glued which consist preferably of strengthened wood. Also the upright is provided with such plates (references 280 and 290). The outer plate 280 of the upright is likewise continued upwardly beyond the line 230 while the upper plate 270 of the cross member runs through to the left-hand frame corner. The lower plate 270 of the cross-member extends only up to the joint 300 while the inner plate 290 of the upright ends at the line 230. The upper flanges 240 of the cross member are carried through to the left-hand frame corner and are there interleaved with the upper ends of the outer flanges 200 of the upright. The lower flanges 250 of the cross member fit over the upper ends of the inner flanges 210 of the upright and abut against members 200*a* which are glued on to the inner surfaces of the outer flanges 200 of the upright extending transversely to the web surfaces. The members 200*a* extend from the left-hand upper frame corner downwardly a certain distance beyond the joint 230. In the vicinity of the members 200*a* intermediate rectangular timbers 200*b* are glued in between the outer flanges 200 (Fig. 18). Also the inner flanges 210 of the upright are provided with members 210*a* which extend downwardly exactly as far as the members 250*a*. In the vicinity of the members 250*a* intermediate timbers 210*b* are glued in between the inner flanges 210. The same arrangement is provided for the cross member. As shown by Figs. 15, 16 and 19 members 240*a* are glued on to the lower side of the ends near to the frame corner of the upper flanges 240 while the lower flanges 250 are provided with members 250. 250*b* and 270*b* are glued in intermediate timbers. Between the inner flanges 210 of the upright and the lower flanges 250 of the cross member inclined supporting flanges 310 are provided, on the outer side of which a suitable plate 320 is glued. The left-hand end of the two web plates 260 of the upright is broadened corresponding to the outline of the frame corner. The two web plates 360 end at the line 300. Between the ends 230 and 300 of the web plates 220 and 260 on each side a plywood web plate 330 is glued on to the outside of the flanges of the upright and cross member. Near to the joint 230 and the joint 300 the space between the flanges is completely filled by glued in short timbers 340. The wood body obtained in this way in the vicinity of the joints 230 and 300 is recessed on the right and left sides and in the recess a joint covering plate 340*a* or 350 is glued.

In the vicinity of the frame corner two plates 360, 370 having the shape shown in Fig. 22 are arranged in the interior of the box girder. The plates 360 and 370 are glued into corresponding recesses in the inner surfaces of the rectangular

timbers 200, 200*a*, 200*b*, 210, 210*a*, 210*b*, 240, 240*a*, 250, 250*a*, 250*b*, 270*b*. These plates are carried through upwardly and to the left up to the outside of the frame. The plates 270, 280 glued on to the outsides of the flanges 200 and on to the upper sides of the flanges 240 are suitably recessed as illustrated in Fig. 23 for the plate 280. Also the plates 280 and 270 may be extended from the outer edges of the intermediate corner plates 360 and 370 in which case the corner plates 360 and 370 become correspondingly narrower and lower. The corner plates 360 and 370 form an additional force transmission whereby a uniform distribution of the stress from the whole girder cross-section is obtained. In this way it is possible considerably to increase the span of frame girders composed of rectangular timber flanges and plywood webs secured together with artificial resin glue.

According to the invention much additional force transmitting plates are arranged in the interior of the box girder also at other places in the frame girder. The upright illustrated in Figs. 15 to 23 is made complete in the workshop. Its assembly with the corresponding halves of the cross member is effected on the building site. In Figs. 24 to 29 the assembly joint is illustrated which is made on the building site when assembling the upright with the corresponding half of the cross member.

The plywood plates 260 of the upright extend to the line S*t* which represents the joint. The flanges 240 and 250 of the upright are somewhat shorter than the web plates 260; they end at the line x. Each of the two timbers 240 and 250 is provided with an outer recess 400 and an inner recess 410. Between the two upper flanges 240 and the two lower flanges 250 is glued in each case an intermediate member consisting of two superposed rectangular timbers 430*a*, 430*b* or 440*a*, 440*b* which extends up to the joint S*t*.

The end of the cross member lying near to the joint S*t* is constructed in exactly the same manner. The cross member consists of the two upper flanges 450 and the two lower flanges 460 and the two web plates 470 and 480. Between the upper flanges 450 is glued an intermediate member consisting of two superposed timbers 490. Between the two lower flanges 460 is glued an intermediate member consisting of two superposed timbers 500. y indicates the line up to which the flanges 450 and 460 of the cross member extend. As shown in Fig. 22 these lines are not parallel to the joint S*t* but form an acute angle therewith. In this way between the ends of the flanges of the upright and the ends of the flanges of the cross member spaces are formed which are somewhat tapered downwardly. Wedge plates 510 are inserted and glued into these spaces. In the inner recesses 410 of the flanges of the upright and the corresponding inner recesses of the flanges of the cross member additional force transmitting plates 520 are glued. The joints x and y are moreover covered by thin joint covering plates 530 which are placed in the above mentioned outer recesses 400 of the flanges.

In Figs. 27 to 29 the assembly joint is illustrated which is constructed on the building site for connecting the upper ends of the two halves of the cross member. The upper flanges 450 of the lower flanges 460 of the left-hand half of the cross member extend up to the line u while the upper flanges 450*a* of the lower flanges 460*a* of the right-hand half of the cross member extend up to the line w. These two lines with the joint S*to* form an upwardly directed acute angle. In this way between the opposite ends of the flanges of the two halves of the cross member a hollow space is formed which is narrowed towards the top. This hollow space is filled up by means of the joint covering plates 600. The flanges 450, 460, 450*a* and 460*a* are provided with inner recesses which receive the additional force transmitting plates 610. Moreover the said flanges have outer recesses in which are inserted thin plates 620 formed of two pieces. Each of these plates serves for covering the joint u while the other half of the plate 620 covers the joint w. Between the flanges 450 and 450*a* or 460 and 460*a* intermediate timbers 630 or 640 are inserted which extend up to the joint S*to*. All these parts are glued together using artificial resin glue. As shown in Fig. 27 the outline of the wedge plate 600 is made such that the lower edge of the plate 600 bridges over the inner corner of the upright.

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PUBLISHED
APRIL 27, 1943.
BY A. P. C.

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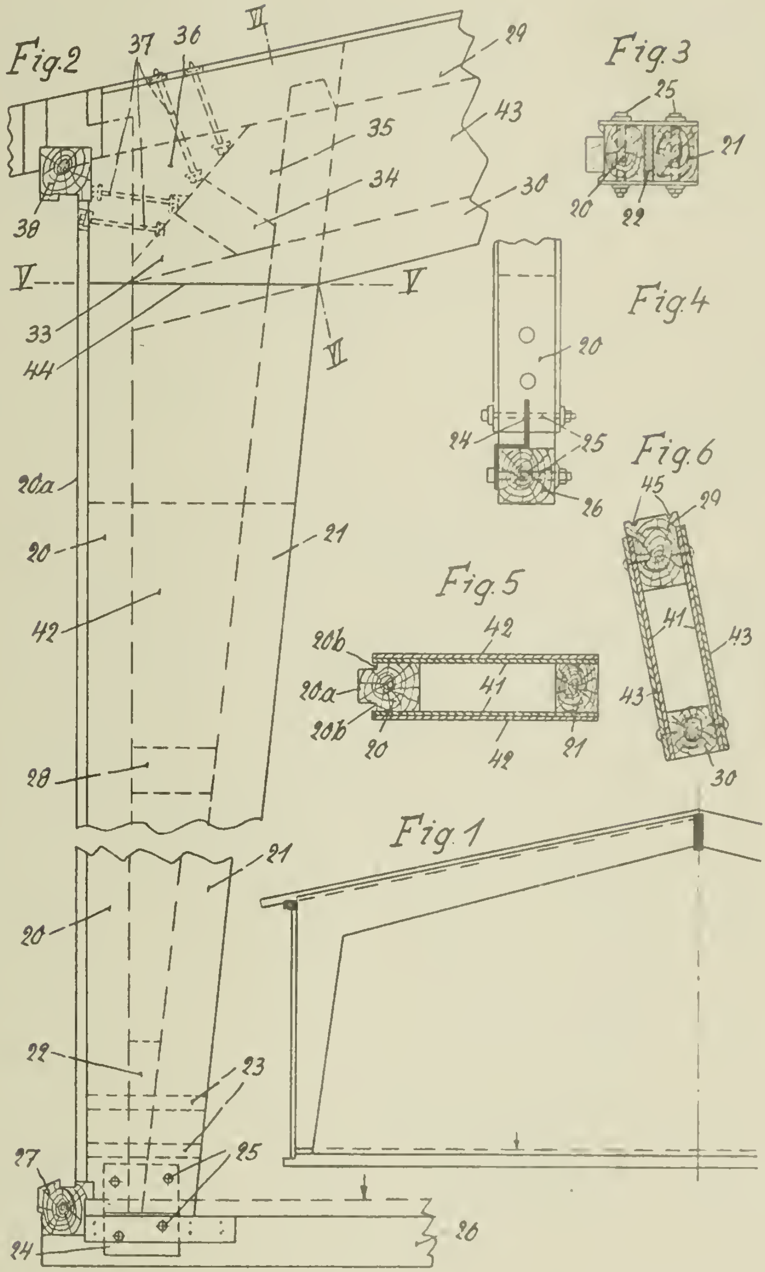
WOODEN FRAME TRUSSES
Filed Oct. 19, 1938

Serial No.
235,842
6 Sheets-Sheet 1



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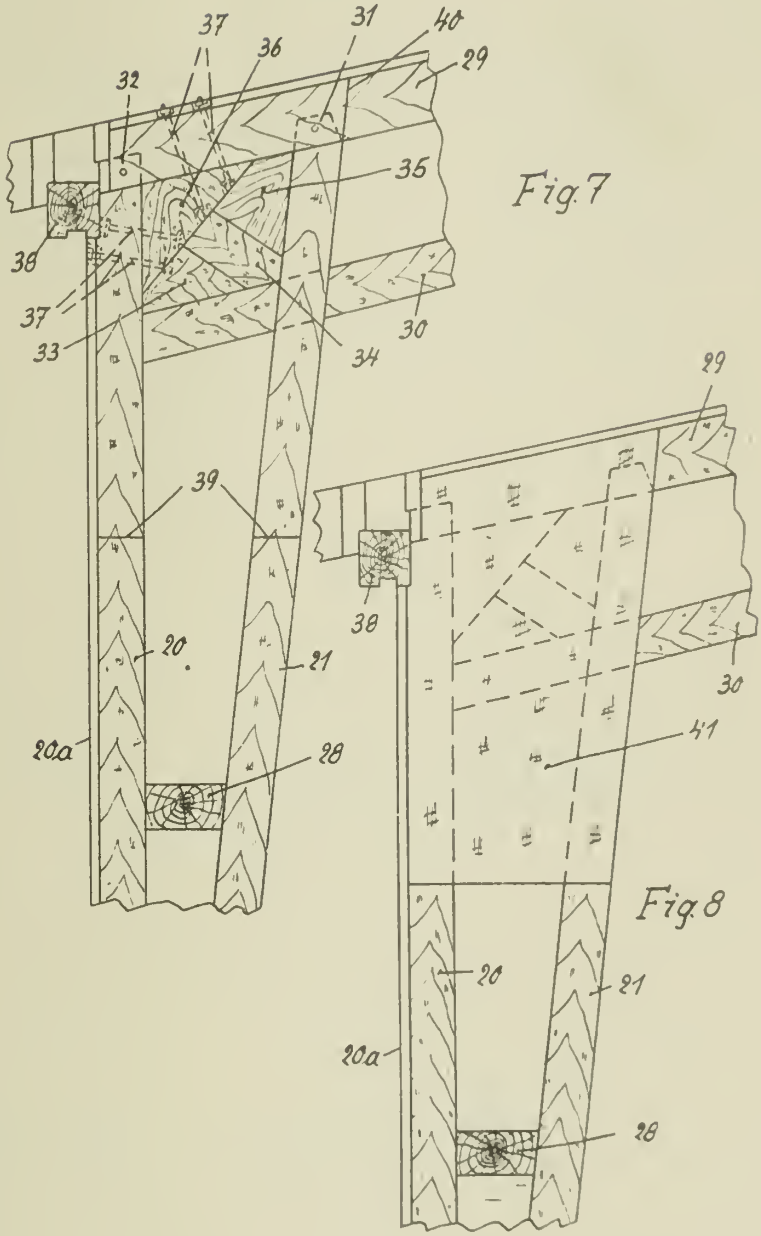
PUBLISHED
APRIL 27, 1943.
BY A. P. C.

W. SAHLBERG
WOODEN FRAME TRUSSES
Filed Oct. 19, 1938

Serial No.
235,842
6 Sheets-Sheet 2



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APRIL 27, 1943.
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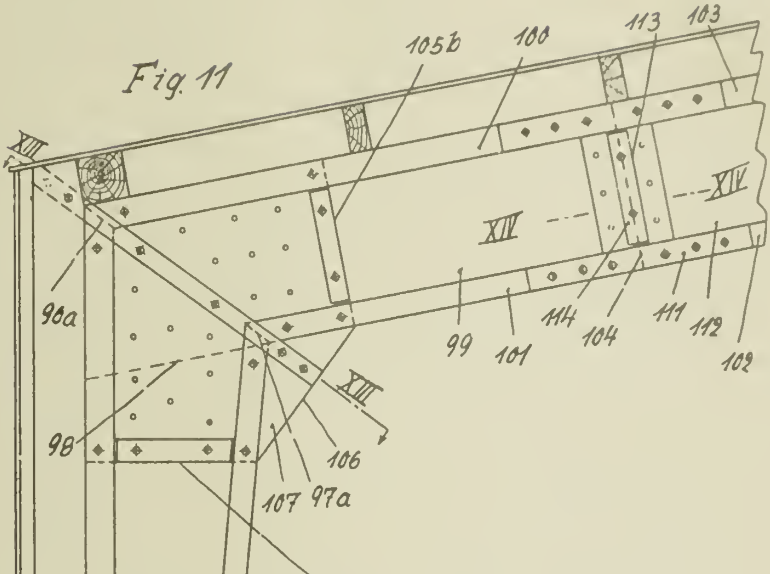
WOODEN FRAME TRUSSES
Filed Oct. 19, 1938

Serial No.
235,842
6 Sheets-Sheet 3

Fig. 11



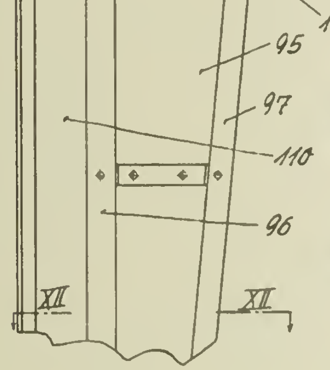


Fig. 13

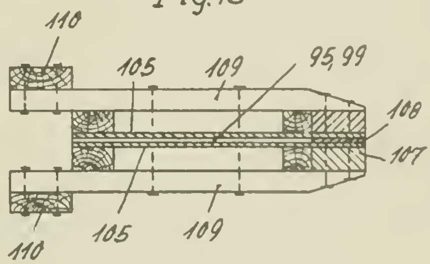


Fig. 12

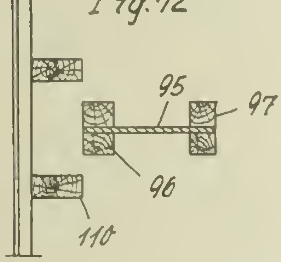
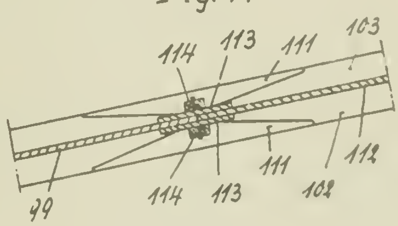


Fig. 14



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WOODEN FRAME TRUSSES
Filed Oct. 19, 1938

Serial No.
235,842
6 Sheets-Sheet 4

Fig. 15

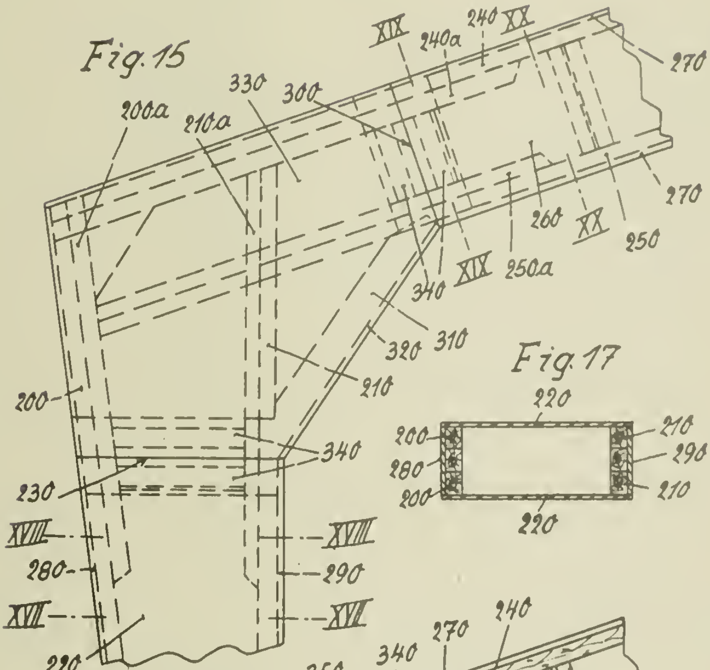

Fig. 17

Fig. 16

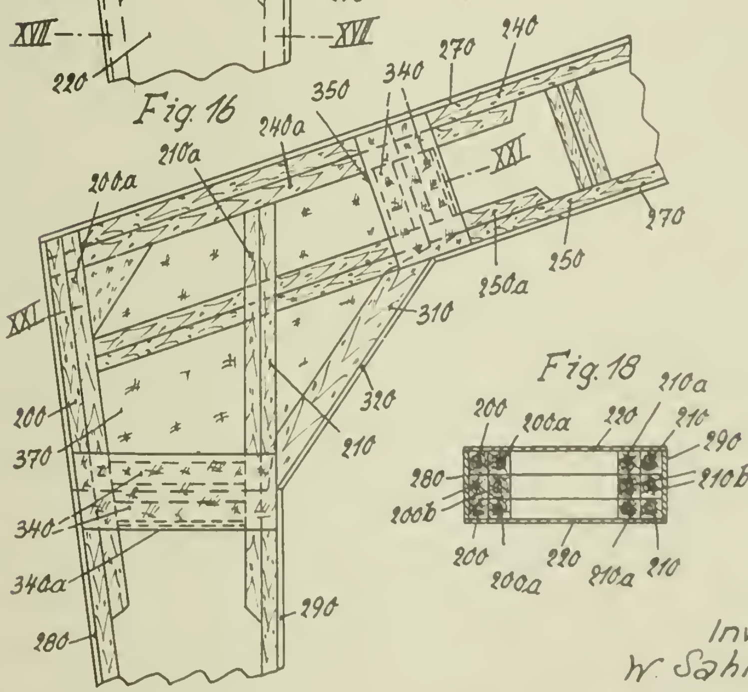

Fig. 18

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PUBLISHED
APRIL 27, 1943.
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WOODEN FRAME TRUSSES
Filed Oct. 19, 1938

Serial No.
235,842
6 Sheets-Sheet 5

Fig. 19

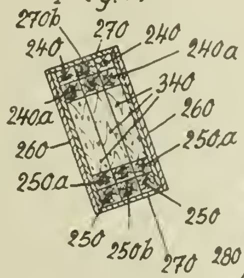


Fig. 21

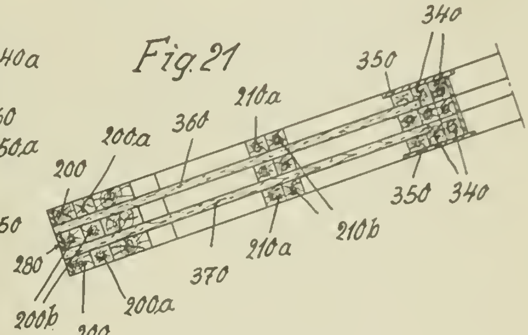


Fig. 20

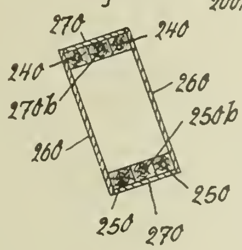


Fig. 22

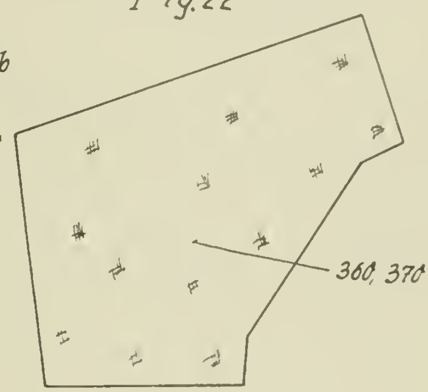


Fig. 23

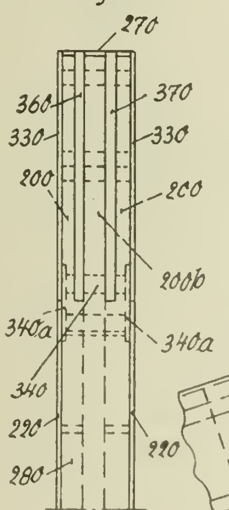
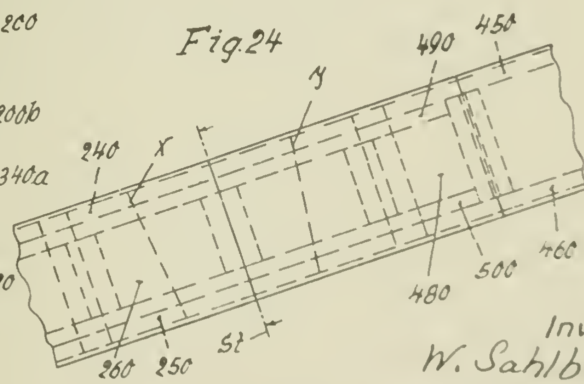


Fig. 24



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WOODEN FRAME TRUSSES
Filed Oct. 19, 1938

Serial No.
235,842
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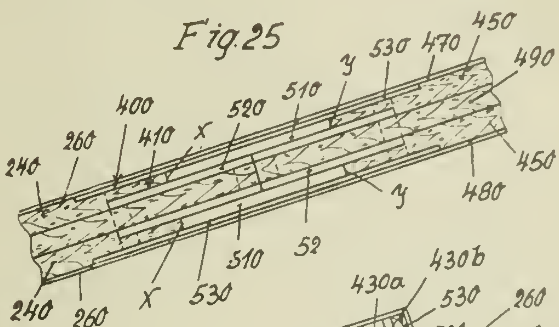
Fig. 25



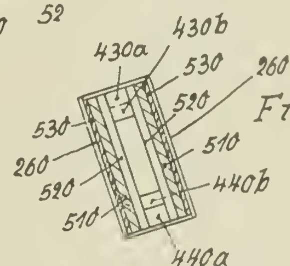


Fig. 26

Fig. 27

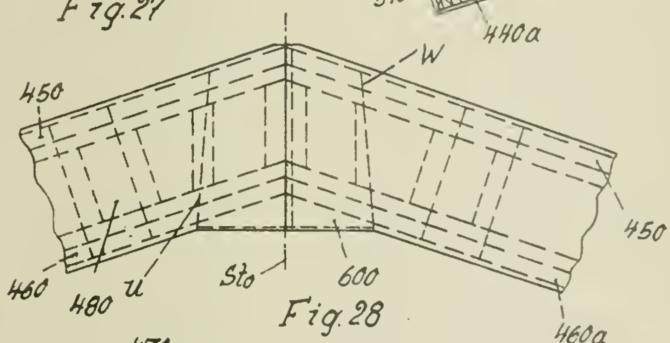


Fig. 28

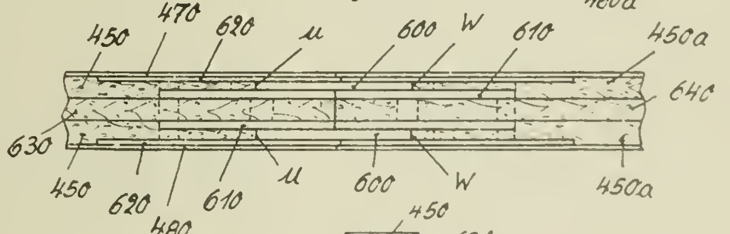
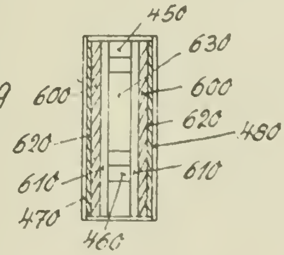


Fig. 29



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Published Apr. 27, 1943

Serial No. 238,144

ALIEN PROPERTY CUSTODIAN

STAPLING DEVICES

Rudolf Vancura, Wien/Vienna, Germany; vested in the Alien Property Custodian

Application filed November 1, 1938

This invention relates to stapling devices, more particularly of the jaw type. Stapling devices of this description have become known in which there is articulately connected to the lower portion of the device a cap by means of which the upper portion, which is pivotally mounted on the lower portion, is pressed against the lower portion and against the matter to be stapled, and by means of which the driver (for detaching the individual staples and carrying out the stapling operation) is forced down. The invention resides in the fact that the cap is so shaped, at its front or rear portion, that it is possible to move the cap about its axis of rotation (through about 180°) into a position in front of the front (jaw side) or back of the device. The advantages obtained in this manner will be set forth in due course.

A form of construction of a jaw type stapling device embodying the present invention is shown, by way of example, in the accompanying drawings in which the device is shown on a magnified scale, and in which

Figs. 1, 2, and 3 show the device in elevation, and partly in section, in three different phases of its operative movement, while

Fig. 4 is a section taken on the line 4—4 of Fig. 1.

Referring to the drawings, the stapling device according to the invention, which is in the form of a flat pocket stapling appliance of the jaw type, consists in a known manner of a lower portion *a* with the upsetting swage plate *b* at the outer end and an upper portion pivoted to the lower portion at *c*. This upper portion comprises essentially the guideway *e* for the coherent strip of staples, this guideway being bent vertically upwards at the outer end to form the portion *e'*. Between this portion *e'* of the staple guideway and the covering end plate *g* there travels the plunger or driver *f*; with its lower portion the covering plate *g* covers up the outer end of the horizontal staple channel (*e*). In the lower portion *a* of the device, or rather in the two upwardly extending side walls *a'* thereof there is further pivotally mounted at *d* the actuating lever *h* which is coupled with the driver *f*. Against the lever *h* or an extension (roller) *i* on the same there bears from above a cap *k* articulated to the lower part of the device at *m*, preferably with the interposition of a roller I. The cap embraces with its side walls from above the lower portion of the stapling device (Fig. 4) or rather its side walls *a'* together with the other constituent parts; inversely, however, the side walls of the lower part *a* might embrace the side walls of the cap *k*. The cap is slightly rocked in a known manner by pressure exerted by the hand in which the stapling device is gripped, with the result that the actuating lever *h* is also moved.

In order that the lever *h* shall be automatically returned into its position of rest after actuation the lug *i* thereon bears from above against the one straight end N of a helical spring wrapped around the pivot pin *d*, while the other straight end *n* bears from above against the staple guideway *e*; at the same time the force or torque of the portion N of the spring is greater than that of the portion *n* of the spring. The two arms N and *n* correspond to the known driver spring in the upright or pedestal stapling devices and to the lifting up spring pertaining to the upper part of the device (or to the staple guide).

By the swinging down of the lever *h* the action of the stronger spring N is first cancelled. so that the spring *n*, with the result that the spring *n* swings the staple guide *e* down until it bears agains the matter to be stapled (Fig. 2); on the further swinging down of the lever *h* the driver *f* is forced down and the stapling operation thereby effected. On cessation of the pressure exerted upon the cap *k*, owing to the action of the spring N, the lever *h* and all the other elements of the device are returned into their initial positions (Fig. 1).

According to the invention the cap *k* at the front (jaw end) or at the rear end of the stapling device is so shaped that it becomes possible to swing the cap *k* round, about its axis *m*—through about 180°—into a position in front of the forward or rear end of the device. For this purpose the cap *k* may be so curved (Fig. 1) from the corner up to the vertical plane passing through its axis of rotation *m*, that it is capable of being swung round with the corner of the upper part as the axis of rotation. Instead of this a suitable aperture may be left in the front or in the back wall of the cap.

When the cap *k* has been swung round the otherwise covered upper part of the device, together with the various elements thereof, are exposed for cleaning, and lubricating the rotary parts, and the like.

Instead of making the cap revoluble about the axis into a position in front of the front and rear side of the device, respectively, it is also possible to make a portion of the same movable in this manner.

In the event of the cap *k* being made revoluble just around the front side of the device it not only

gives access to the constituent parts of the device but also serves as a protecting cap. For if in the known devices the mistake be made of forgetting to remove the constantly spring-loaded staple pushing up member before the covering plate is pushed up the portion or any portion of the strip of staples left in the feed channel will jump out at the front end of the channel and is liable to injure the user of the device; in the present case, on the other hand, any staples that may be suddenly protuded by such action (in the direction indicated by the arrow **3** in Fig. 3) are caught by the hinged down cap.

The covering plate *g* is preferably slidably mounted on the vertical portion *e'* (for the purpose of removing any staples that may happen to become stuck or jammed), and the means provided (e. g. depressions *g'*) for engagement by the fingers in effecting upward displacement are provided on its side or rear wings, so that the engaging means are only rendered accessible when the cap has been swung into position in front of the front side of the device (Fig. 3) when it is capable of serving as a protecting cap for ejected staples. The covering plate can then be lifted from its normal position (Fig. 1) into its raised position (Fig. 3).

The covering plate *g* is preferably only of such height that when it is in the raised position (Fig. 3) it does not extend beyond the upper edge of the vertical portion *e'* and thus does not obstruct the swinging back (swinging up, as indicated by arrow **5**) of the hinged down cap *k*. When the cap *k* is in the swung back position, since the covering plate *g* is still in the elevated position, the horizontal staple channel *e* is exposed for examination and cleaning. Finally, by pressure exerted upon the swung back cap, by means of the lever *h*, the elevated covering plate *g* (Fig. 3) is lowered into its normal position (Fig. 1).

In its normal position the cap *k* is arrested on the lower portion (*a*) of the device by means of a spring member. As such member there may be used the pivot *d* of the actuating lever or a pin disposed in the hollow pivot axle, which with its other end extends into an arcuate slot *o* in the cap and is axially displaceable against the action of a spring. In order that, on being swung back, the cap *k* may be able to be moved down from above over the projecting end of this pin, without this latter having to be first forced back with the finger, the cap *k* is champfered off to a sharp edge or provided with a groove at the lower edge opposite the axis *d*.

The transmission of the movement of the cap *k* to the actuating lever *h* may be effected by means of a separate contrivance which takes account of the fact that the swinging movement of the cap by the hand gripping the stapling device, owing to the interengagement of the cap and the under portion of the device, can not be as great as in the case of the known jaw type stapling devices having two projecting handle limbs. In accordance with the invention the transmission means are so devised that the path and velocity of the swung down lever is greatest at the start and smallest at the end of its movement. Consequently the swinging down of the upper part of the device towards the matter to be stapled takes place rapidly, while the succeeding driving down of the driver is effected more slowly but with proportionately greater force. In the form of construction of this type of device shown in the drawings the two rollers I and *i* are so disposed relatively to each other that their paths of movement fulfil the said condition. When the cap *k* is swung the roller I describes an arc **1** about *m* as the centre and the roller *i* an arc **2** about *d* as the centre. The path of movement of the roller I, which is initially at right angles to the periphery of the roller *i*, (see Fig. 1), becomes finally (see Fig. 2) more or less tangential to the periphery of the roller *i*. At the end of its path of movement therefore the roller *i* is moved only through a short distance but with correspondingly greater force, as mentioned above.

RUDOLF VANCURA.

PUBLISHED	R. VANCURA	Serial No.
APRIL 27, 1943.	STAPLING DEVICES	238,144
BY A. P. C.	Filed Nov. 1, 1938	3 Sheets-Sheet 1

Fig. 1

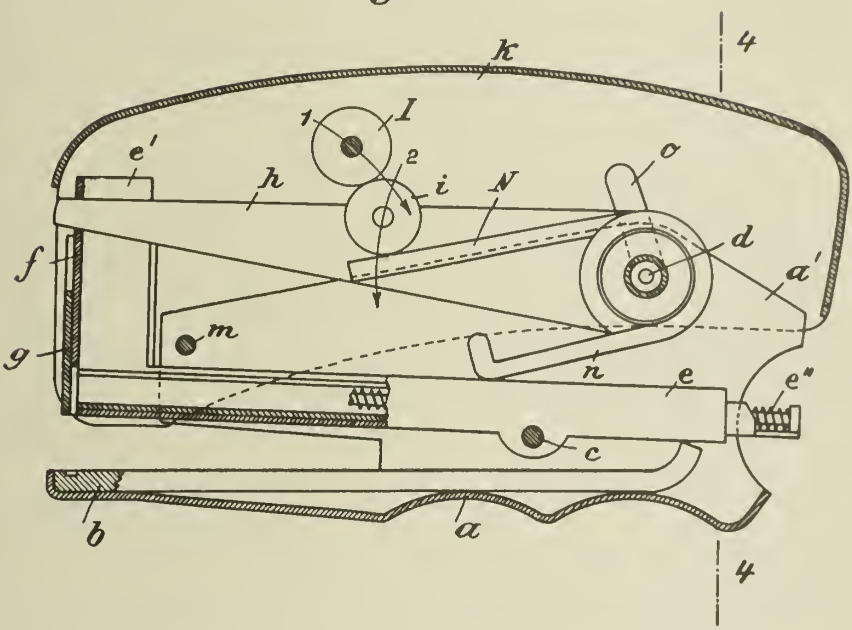
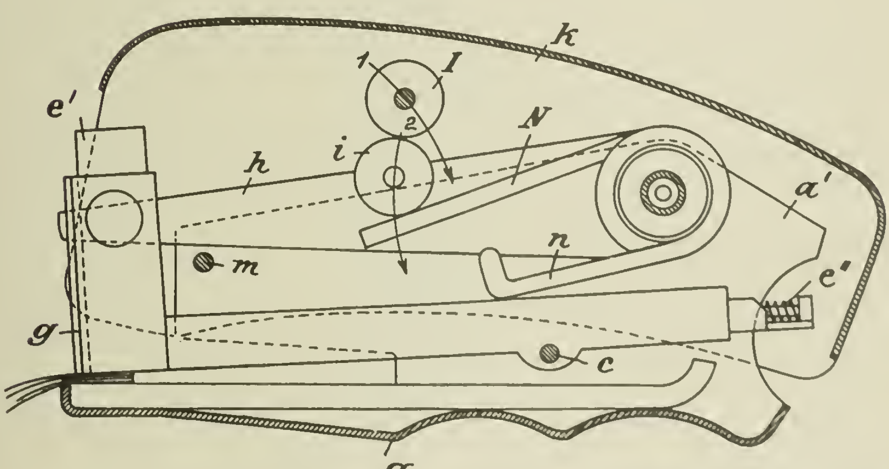


Fig. 2



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PUBLISHED
APRIL 27, 1943.
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R. VANCURA
STAPLING DEVICES
Filed Nov. 1, 1938

Serial No.
238,144
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Fig.3

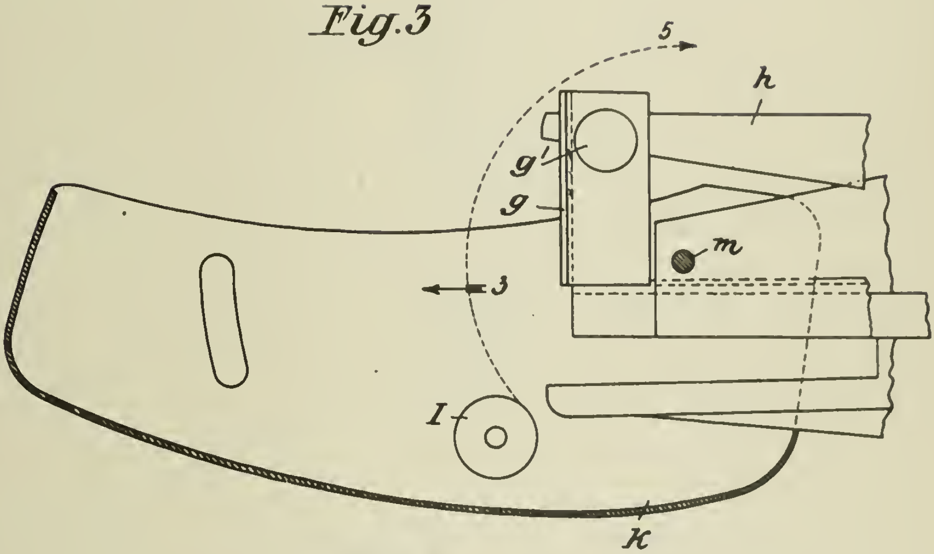
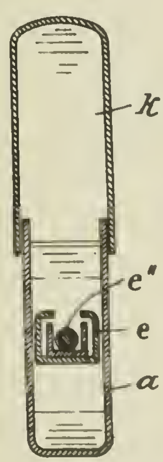


Fig 4



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APRIL 27, 1943.
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STAPLING DEVICES
Filed Nov. 1, 1938

Serial No.
238,144
3 Sheets-Sheet 3

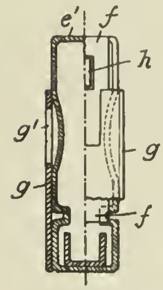

Fig. 5

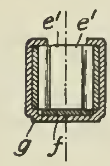

Fig. 6

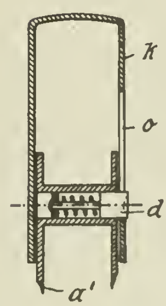

Fig. 7

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Published Apr. 27, 1943 Serial No. 238,270

ALIEN PROPERTY CUSTODIAN

HYDRAULICALLY OPERATING GEARS OR TRANSMITTING DEVICES

Hans Molly, Berlin-Tempelhof, Germany; vested in the Alien Property Custodian

Application filed November 1, 1938

This invention relates to improvements in or relating to hydraulically operating gears or transmitting devices and more particularly to a ball cup for the piston rods of such gears having a ball head engaging said cup.

The primary object of the invention is to simplify the manufacture of such ball cups.

A further object of the invention is to remove the disadvantages of the wellknown cups, comprising two parts—a cup and a retaining disc for closing the cup after the insertion of the piston ball head.

In order to more fully explain the present invention and other aims and advantages thereof in the following description some manufacturing processes according to the invention are described with reference to the accompanying drawings in which

Fig. 1 is a perspective view partly in section of a hydraulically operating transmission gear.

Fig. 2 is a section view of the piston ball head and the cup surrounding it, forming part of said gear.

Fig. 3 corresponds to Fig. 2 and shows the ball cup of the wellknown type.

Fig. 4 is a modification of the new construction according to Fig. 2.

Figs. 5, 6 & 7 diagrammatically illustrate the manufacturing process of the new ball cup.

Fig. 8 & 9 diagrammatically illustrate another manufacturing process according to the invention.

Referring now to Fig. 1, the wellknown hydraulically operating gears comprise a pump and a motor. The liquid delivered by the pump may be controlled in any convenient manner so as to control the transmission ratio between the driving shaft of the pump and the motor shaft driven by the liquid delivered by the pump.

Fig. 1 shows for illustrative purposes one embodiment of the pump. The shaft *a* mounted in anti-friction bearings *b* is provided with a driving disc *c* to which the piston rods **1** of a plurality of pistons **4** are linked by means of balls **2** formed at the end of the piston rod. Each piston **4** is mounted in a cylindrical bore *d* of a cylinder block *e* rotatably mounted in a frame *f* having a rocking axis *g* for varying the inclination of the longitudinal axis of the cylinder block *e* to the axis of the driving shaft *a*. In case the angle of inclination is zero, i.e. the axis of the cylinder block *e* coincides with the axis of the driving shaft *a*, the pistons **4** only rotate around the axis of the cylinder block *e*, but do not execute the usual reciprocating piston movement for delivering the transmitting liquid. However, as soon as the axis of the cylinder block *e* is more or less inclined against the axis of the shaft *a*, the pistons **4** reciprocate in their bores *d*, the stroke of the pistons being a function of the inclination angle as will be readily understood from Fig. 1 and as is wellknown.

In the position shown in Fig. 1 the liquid is sucked in through a pipe *h* and a channel *i* provided in the frame *f*, whilst another channel *k* communicates with a pipe *e* for leading the liquid delivered by the pistons to the motor not shown. This motor may be constructed in the same manner as the pump shown in Fig. 1 with the exception that the frame *f*, comprising the cylinder block *e* may be fixedly mounted relative to the axis of the motor shaft so that the stroke volume of the motor cylinders remains constant and the speed of the motor or output shaft may be varied by varying the quantity of liquid delivered by the pump in the manner described with reference to Fig. 1.

The object of the invention is to improve the manufacturing process of the ball cups surrounding the piston ball head **2**. As shown in detailed manner in Fig. 2, the ball cup **5** must surround more than half of the ball **2** in order to be capable of imparting to the piston rod **1** not only a thrust, but also a pull. Previously cups of semi-spherical shape have been used and a special retaining disc **8** provided for closing the cup after the insertion of the piston ball head **2**.

The wellknown ball cups as shown in Fig. 3, comprising two parts have great disadvantages, particularly in case of small gears or transmitting devices. These disadvantages are due to the following reasons:

To provide for hydraulic relief, an annular groove **7** provided in the ball **2** must have substantially the diameter of the piston **4**, in which case it projects, as shown by Fig. 3 into the joint **8** separating the cup **5** and the retaining disc **6**. For this reason, it was previously necessary to do without a complete hydraulic relief of this kind and a temporary, partial relief had to suffice, if it were not desired to use other comparatively expensive and complicated relieving means. If, however, as in Fig. 2, the cup **5** is formed in one piece, a complete hydraulic relief can be obtained through the annular groove **7**, since the annular space always remains within a closed spherical surface, and the distance A is sufficiently large to guard against an excessively abrupt drop in the oil pressure.

The advantage of the ball cup **5** being in one piece also applies fundamentally to the ball cup furnished in the piston **4** for reception of the ball **3**. This renders it unnecessary to guard against dislodging of the ball **3**, after it has been inserted in the piston **4** by a special nut **9** and a bi-partite ring **10**. These additional parts make the manufacture more difficult and expensive, in the case of small dimensions, to such an extent that it has already been proposed to dispense with the possibility of the suction by the piston **4** itself

and to provide a special make-up pump which has the task of maintaining the piston **4** against its ball **3** during the suction stroke in the plant.

If the ball cup within the piston **4** is also made in one piece, this provides a possibility of a constructive, simple means for driving the cylinder block by the piston rod itself. Thus according to Fig. 4, the piston may be extended over practically the whole length of the rod **1** and the rod may be provided with a collar **1a** which only leaves a small amount of play required for dynamical reasons, and therefore moves the piston **4** with the cylinder block during the oscillating movement.

Figs. 5 to 7 illustrate the manufacture of the integral cup. The cup is first of all of semispherical shape and has a cylindrical extended portion **11** and a thickened annular portion **12**. After insertion of the ball **2** in the cup **5**, a tube **13** with a frusto-conical shaped enlargement **14** is forced from the side on which the opening in the cup is located, that is to say in the direction of the arrow **15**, over the cup. In this way the cylindrical projection is forced against the periphery of the ball and the cup is closed (Fig. 6). This pressure, which upsets the material against the periphery of the ball, provides a tight seating which is eased by a further operation. Thus the tube **13** is forced in the same direction and as a result of the thickened portion **12a** of the material (Fig. 6) the material is compressed to the maximum diameter permitting the sliding thereover of the pipe, and is extended, so that the projection **11** which is upset against the periphery of the ball during the first operation is moved away from the ball to some extent as shown, greatly exaggerated, in Fig. 7. In this way the ball is given the desired easy movement in its cup.

The piston rod is formed fundamentally the same way.

The specific high pressures, which may occur in hydraulic mechanisms render it necessary to impart to the balls and ball cups the requisite hardness. The alloys which would be suitable when carrying out the method of manufacture according to the invention, are in general too soft. For this reason, it is advisable to choose the materials and to carry out the manufacture in the following fashion:

The piston rod **1** and the two balls **2** and **3** are made of nitro-steel, which has proved in practice to retain its hardness up to a temperature of about 500°. Beryllium bronze, which can be hardened at about a temperature of 300°, which temperature has no influence on the hardness of the nitro-steel balls which have already been inserted, is used for making the ball cups. In this connection, it is important that the beryllium bronze is so soft before the hardening process, that the integral formation by the process according to the present invention occasions no difficulties.

According to a modification of the invention the inventive process may be further improved by employing a tubular blank as shown in Fig. 8 and 9.

This tube **16** has approximately twice the length of the piston to be made and the same wall thickness as this piston. This tube can be turned before the deformation. The tube is provided at its central portion with the collar-like raised portions **17** and **18** which serve for producing the ball socket by deformation. These are located on both sides of the ball **19** which is to be inserted in the tube before the deformation. For reasons which are explained hereinafter, the balls **19** are brought beyond the position corresponding to the exact mean position of the ball between the two collars **17** and **18**. As described with reference to Fig. 5 to 7, a tool **13** is then moved over the tube **16** from each of the two ends of the tube, and thereby each of the collars **17** and **18** are pressed inwardly with deformation of the material of the tube, so that at the end of the deforming process, the shape indicated in Fig. 9 is obtained.

The following special conditions apply on account of the fact that two pistons are here simultaneously formed from a blank. Immediately the tool **13** is pushed over the blank, it acts on the outer collar **17** and presses this inwardly, and under this pressure the ball **19** would yield and draw the piston rod **1** inwards, that is to say, would undesirably effect the correct position of the ball in relation to the collars **17** and **18**. To avoid this, a collar **20** is pushed over the piston rod **1** before the application of the tool **13**, which collar bears on the one side against the outer end of the tube **16** and on the other side against the outer ball **21**. This retains the piston rod **1** in the correct position against the traction exerted on the ball during the deformation and can be withdrawn after the tool **13** is removed. To this end it is provided with a lateral opening.

Upon the further moving of the tool **13** over the second collar **18**, this presses on the ball **19** in such a way as to relieve the collar **20** so that the latter can be withdrawn without effort after the deformation. If the ball **19** were to lie exactly symmetrically between the two collars **17** and **18** during the deformation, the forcing of the collar **20** caused by the deformation of the first collar **17** would not be sufficiently compensated by the deformation of the second collar **18** to enable the collar **20** to be withdrawn without being expanded. Moreover there is the danger in this instance that the piston rod **1** would undergo excessive strain due to the tractive forces.

Basically, the two collars **18** could be combined to form a single collar extending over the central portion of the tube (as indicated in dotted lines in Fig. 8). However, in order to make as little work in deformation as possible, it is advisable to separate the two collars from one another, and to furnish yet another collar **22** between the two collars, this further collar being advantageously wider or thicker than the collars **17** and **18**. In this way the result is achieved that the end position of the tool **13** illustrated in Fig. 9 is symmetrical with respect to the two pistons to be made, whereas otherwise, the end position as regards the desired symmetry is not safeguarded.

After withdrawing the tool **13** and the collar **20**, the two pistons which are still connected together can first of all be turned. During this process, in each case, one of the pistons can serve for the clamping. In the last operation, the two pistons are separated one from the other at the central part.

The manufacturing process according to Figs. 8 and 9 has the advantage of the process according to Figs. 5 to 7 that after the deformation the piston **4** has only to be turned from the exterior, i. e. a working of the piston from inside is dispensed with. Moreover, by manufacturing two pistons from one blank not only a special projection on the blank for chucking (for the subsequent turning) is saved, but the chucking is simplified.

HANS MOLLY.

PUBLISHED

APRIL 27, 1943.

BY A. P. C.

H. MOLLY
HYDRAULICALLY OPERATING GEARS
OR TRANSMITTING DEVICES
Filed Nov. 1, 1938

Serial No.
238,270

3 Sheets-Sheet 1

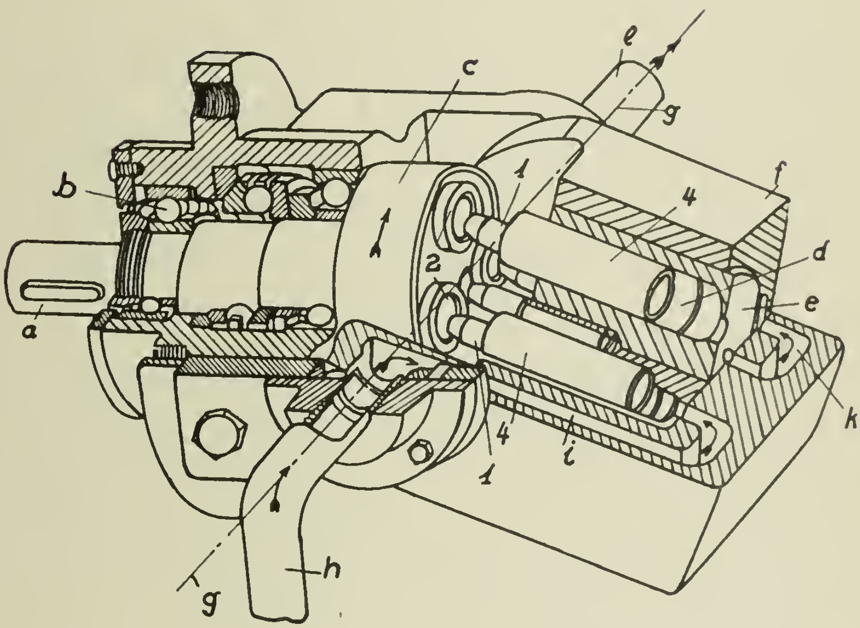

Fig. 1.

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PUBLISHED

APRIL 27, 1943.

BY A. P. C.

H. MOLLY

HYDRAULICALLY OPERATING GEARS
OR TRANSMITTING DEVICES

Filed Nov. 1, 1938

Serial No.
238,270

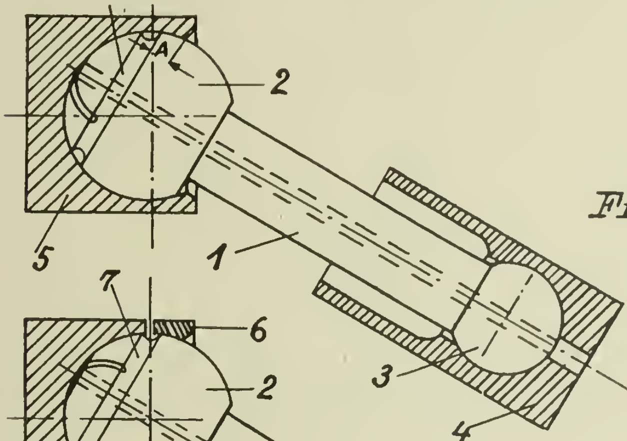


Fig.2.

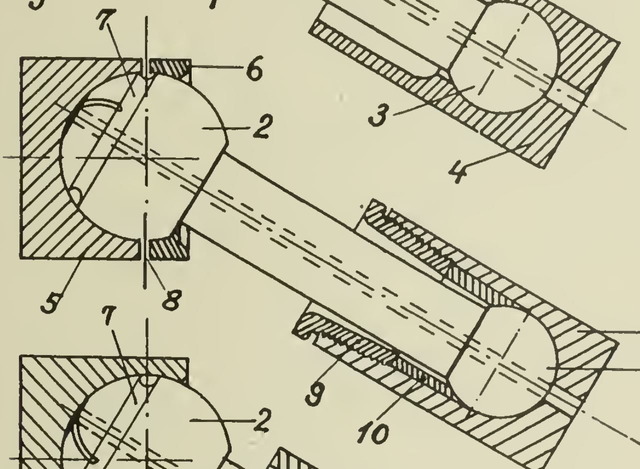


Fig.3.

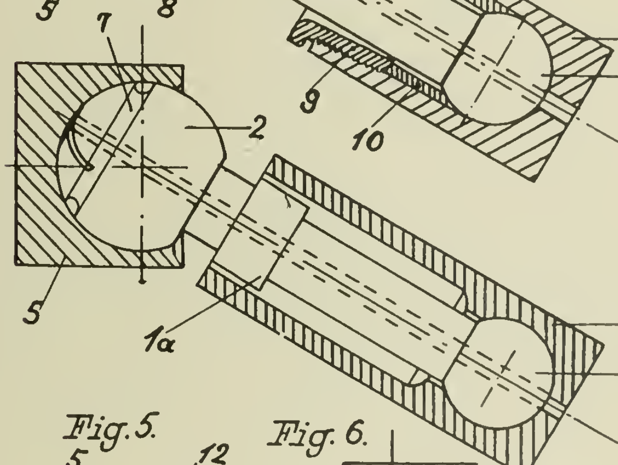


Fig.4.

Fig.5.

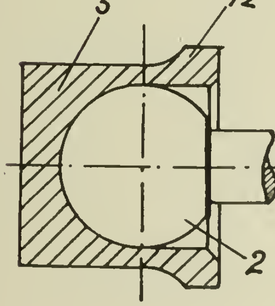


Fig. 6.

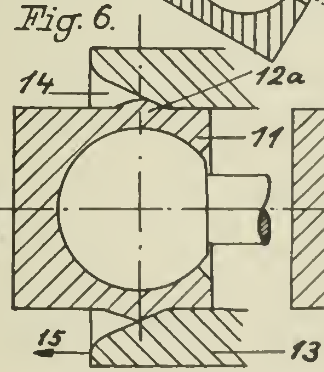
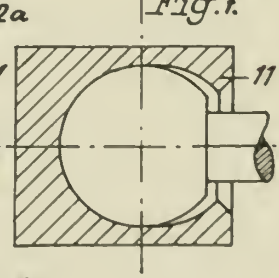


Fig.7.



Inventor:
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PUBLISHED

APRIL 27, 1943.

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H. MOLLY
HYDRAULICALLY OPERATING GEARS
OR TRANSMITTING DEVICES
Filed Nov. 1, 1938

Serial No.
238,270

3 Sheets-Sheet 3

Fig. 8.

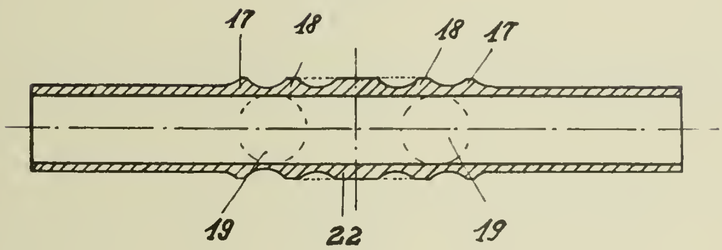
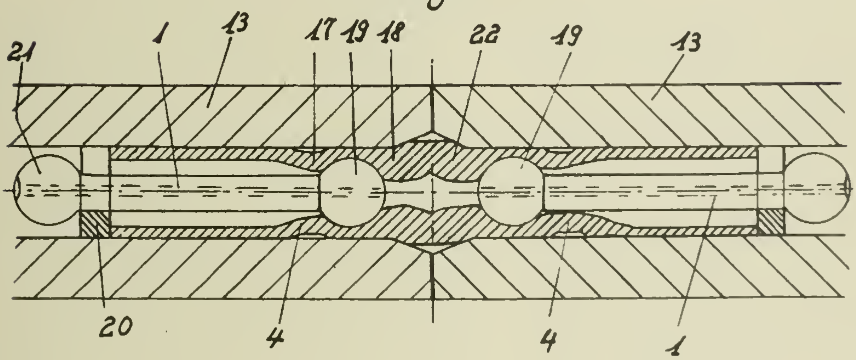


Fig. 9.



Inventor:
Hans Molly

By A. D. Adams
Attorney

Published Apr. 27, 1943

Serial No. 240,197

ALIEN PROPERTY CUSTODIAN

ELECTRO-MAGNET BRAKING DEVICE FOR TRAILERS OF MOTOR VEHICLES

Paul Schmidt, Solingen, Germany; vested in the Alien Property Custodian

Application filed November 12, 1938

This invention relates to an electro-magnet braking device for trailers of motor vehicles.

Up to the present single or multiple axle trailers hitched to private cars or to light lorries cannot be properly braked from the motor vehicle because, contrary to heavy lorries, a suitable braking device is lacking. In the case of heavy lorries this objection does not arise owing to the presence of a pneumatic brake necessary for increasing safe service, this brake being connected with a similar brake system of the trailer or trailers with the result that they are reliably and permanently braked from the motor vehicle when this is being braked. The use of a pneumatic brake is only suitable for heavy lorries, in which the pneumatic brake can operate to full capacity. In the case of light lorries and even private cars to which trailers are hitched, the use of a pneumatic brake would not be practical, apart from the fact that the cost of the installation of a pneumatic brake is so high that it constitutes a primary factor not in the case of heavy lorries, but in the case of light lorries or even private cars, merely to enable the braking of the trailer. Consequently, so-called close-up brakes are used, which, however, are open to the objection that for example when running down hill and when the trailer closes up to the motor vehicle, an undesired braking effect is produced by the close-up brake and causes detrimental jerk-like shocks on the gear and differential of the engine of the motor vehicle. Further, the objections of a close-up brake become particularly apparent when a motor vehicle to which a trailer is hitched must be run in reverse owing to some circumstances due to the service or traffic as then the wheels of the trailer block, even if the close-up brake is in proper condition. The damages which may result herefrom, especially if the blocking is repeated frequently, are considerable.

These objections are overcome by the invention in that when contacts are actuated by means of the brake pedal, a horse-shoe magnet with independent coils attracts a horizontal plate at one end by one of the coils, or at both ends by the two coils, the plate surrounding the piston rod of the liquid pressure piston of the main cylinder and being hingedly connected thereto.

Instead of the horse-shoe magnet two pot-shaped magnets may be used in such a manner that, when contacts are actuated by means of the brake pedal, one or both of the opposite pot-shaped magnets attracts or attract a plate arranged in front of the same, each plate surrounding the piston rod of a liquid pressure piston of a common main cylinder, extending through the corresponding magnet.

By means of the braking device according to the invention, which can easily be connected to an oil pressure or mechanical brake, the trailer hitched to a private car or light lorry can be effectively and lastingly braked from the motor vehicle.

Two embodiments of the invention are illustrated by way of example in the accompanying drawing in which:

Fig. 1 shows in plan view a device with horse-shoe magnets,

Fig. 2 is a side elevation of Fig. 1,

Fig. 3 is a diagrammatic view of the chassis of a trailer,

Fig. 4 shows in side elevation a device with two pot-shaped magnets,

Fig. 5 is a side elevation of Fig. 4,

Fig. 6 is a section on line **6—6** of Fig. 4.

The braking device illustrated in Figs. 1, 2 and 3 consists of a horse-shoe magnet *a* with separate coils *b*, *b'* and with a horizontal plate *c* which surrounds the piston rod *d* of the liquid pressure piston *e* of the main cylinder *f* and is hingedly connected therewith. The plate c is longitudinally shiftable in bearing brackets *g*, *g'* by means of bolts *h*, *h'*.

The device operates in the following manner: When a contact is actuated by means of the brake pedal and closes a circuit from a source of current into the magnet *a*, the horizontal plate *c* is attracted at one end by one of the coils or at both ends by both coils *b*, *b'* according to whether the trailer is to be gently or strongly braked. Consequently, the liquid pressure piston *e* of the cylinder *f* is moved outwards. A tube *i* extends from the cylinder *f* and branches into two arms leading to the rear axle of the trailer and each terminating in a braking cylinder mounted in the brake disc, the pistons of the braking cylinder acting directly on the brake blocks or on the brake bands. The piston *e* in moving forward exerts a pressure on the braking liquid enclosed in the tube *i* and is transmitted uniformly over the entire area of the tube according to physical law and thus also gets into the braking cylinder whose piston is thus forced outwards and brings the brake blocks to bear on the brake drum with the result that the desired braking effect is obtained.

The braking device illustrated in Figs. 4, 5 and 6 differs from that above described merely in that two pot-shaped magnets are used instead of a horse-shoe magnet. Each of these pot-shaped

magnets comprises a core k, a coil l and a pot m screwed on to the core k. The pot-shaped magnets are fixed by screws on the frame n of the device. Plates o, o' are mounted on bolts p, p' one in front of each of the pot-magnets, and surround piston rods q, q' respectively of the liquid pressure pistons r, r' mounted in a common main cylinder s from whose bores t, t' pipes extend to the rear axle of the trailer. A pump u serves for pumping the oil into the main cylinder s.

This braking device operates in substantially the same manner as that above described.

When a contact is actuated by the brake pedal, current is supplied to the pot-shaped magnets from a source of current, and one or both of the plates o, o' are attracted by the pot-shaped magnets according to whether the trailer is to be gently or strongly braked. The pistons r, r' are thus moved outwards and thus exert pressu the braking liquid in the pipe conducts, w pressure is necessary for obtaining the br effect in the manner above described.

PAUL SCHMIDT.

PUBLISHED

APRIL 27, 1943.

BY A. P. C.

P. SCHMIDT

MASTER CYLINDER UNIT

Filed Nov. 12, 1938

Serial No.
240,197

Fig.1 Fig 5 Fig. 2 Fig. 3 Fig. 4

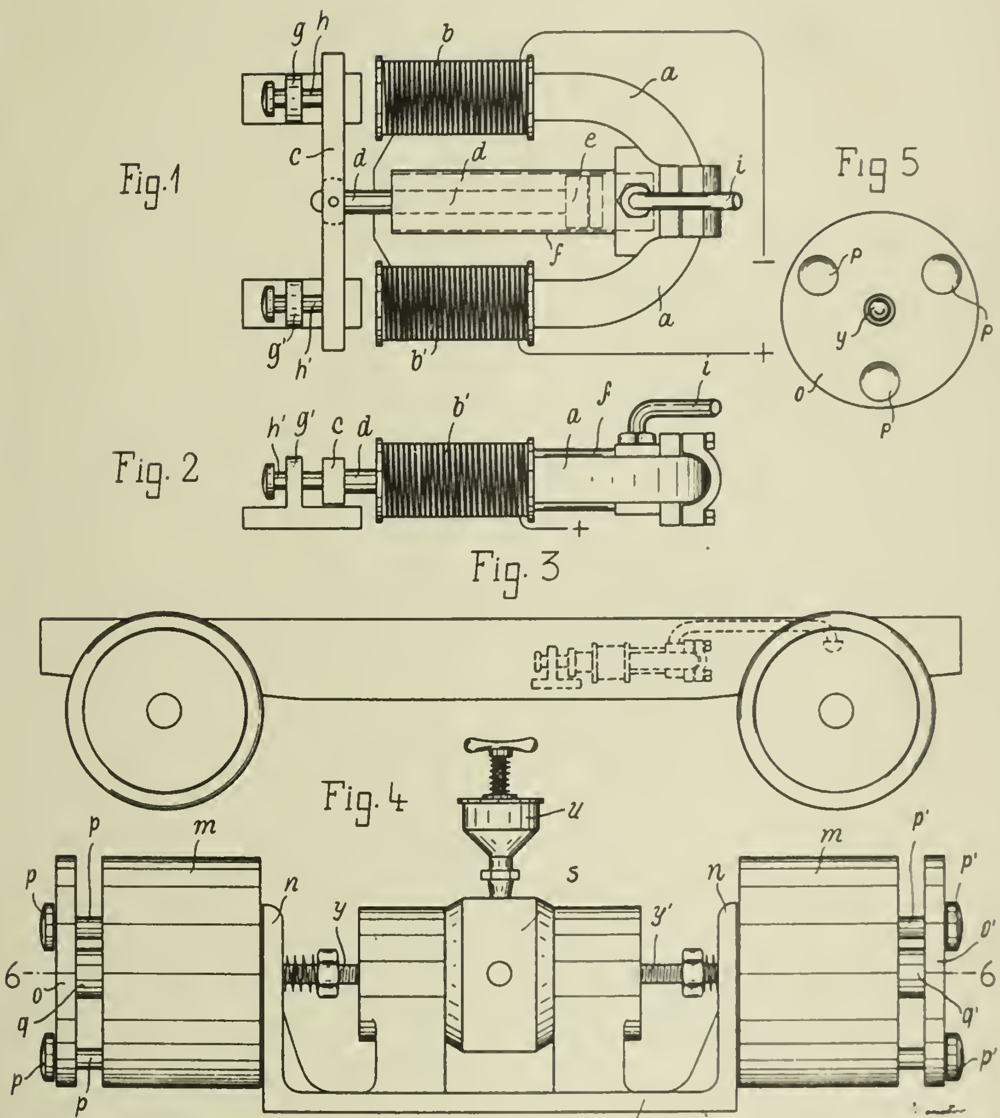
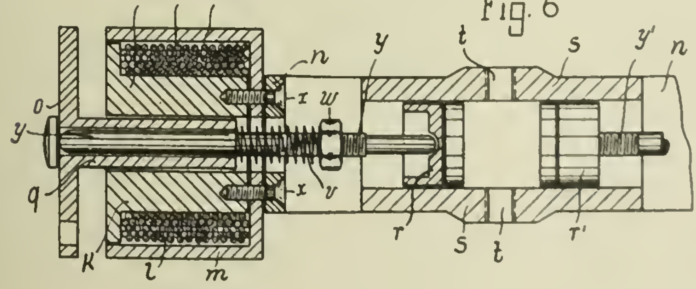


Fig. 6



INVENTOR
Paul Schmidt

BY

ATTORNEY

Published Apr. 27, 1943

Serial No. 240,907

ALIEN PROPERTY CUSTODIAN

COMBUSTION CHAMBERS

Max Adolf Müller, Biederitz, Germany; vested in the Alien Property Custodian

Application filed November 17, 1938

This invention relates to improvements in combustion chambers, and refers particularly to combustion chambers wherein fluid, liquid or powdered combustible material is to be mixed with air and burnt.

It has hitherto been necessary to make such combustion chambers of material which will withstand intense heat, and therefore natural stone or refractory material has most frequently been employed in their construction. Such materials however are quite heavy and so are not suitable for the combustion chambers of gas turbines or rocket motors for use on aeroplanes intended to travel at high altitudes and at great speeds, because in such cases every effort must be made to reduce the weight to a minimum. Again when natural stone or refractory material is used for combustion chambers of gas turbines small pieces break off from time to time and are very liable to damage the turbine vanes.

It is an object of this invention to provide a combustion chamber having sheet metal walls, and to provide means permitting a constant flow of cool air adjacent their inner faces to protect them from the intense heat within the combustion space. Thus I aim to provide a combustion chamber wherein the high temperature of the products of combustion do not necessitate the use of high heat resisting material for the walls due to the fact that the constant flow of cool air forms a protecting layer between them and the high temperature gases; and wherein the walls are also made of a material which is not liable to break off and damage turbine vanes.

Another object of the invention is to provide such a combustion chamber consisting of light sheet metal walls around which a casing is spaced, so that cool air may flow freely between the casing and the walls to dissipate heat which may reach the latter through the protecting layer of cool air flowing adjacent the inner faces of the walls.

A further object of the invention is to provide a combustion chamber which is exceptionally light in weight, and is therefore very suitable for use on aeroplanes, and which can be very cheaply and simply constructed.

Another object of the invention is to provide a combustion chamber wherein a plurality of spaced wall portions confine a combustion space, and the wall portions are arranged within an outer casing through which a cool air inlet and an outlet for the products of combustion are provided, so that air from the inlet flows through channels formed between the casing and the wall portions to dissipate heat from the latter, and wherein between some of the wall portions slot-like passages are formed through which air from the inlet passes into the combustion space to form protecting layers of cool air to protect the inner faces of the said wall portions from the intense heat generated in the combustion space.

Yet another object of the invention is to provide a combustion chamber, in one form of which the products of combustion are directed or deflected by sheet metal wall portions extending into the combustion space; and wherein means are provided permitting a continuous flow of cool air into the said space to form a protecting layer of air to retain the burning gases spaced from the wall portions.

Having thus briefly stated some of the objects and advantages of the invention I will now proceed to describe it in detail with the aid of the accompanying drawings, in which:

Figure 1 illustrates a diagrammatic view showing a longitudinal section through one form of the combustion chamber, and

Figure 2 is a diagrammatic view showing a longitudinal section through a modified form thereof.

Referring to the arrangement shown in Figure 1. The combustion space 1 is confined within a plurality of spaced wall portions 2 which are made of sheet metal, preferably sheet steel. Mounted around the wall portions 2 and spaced therefrom is an outer casing 5 having a cool air inlet 5*a* and an outlet 5*b* for the products of combustion. Projecting through both the casing 5 and at least one of the wall portions 2 are a plurality of fuel inlets 3 through which liquid, fluid, or powdered combustible material is introduced into the combustion chamber 1. A plurality of air inlets 4 are also provided through at least one of the wall portions 2 for the passage of air for combustion purposes from one of the channels 8 defined between the casing 5 and the said wall portions 2. The air entering the inlet 5*a* flows in the direction of the arrows X. Some of this air is employed for combustion purposes as above stated, and the remainder either flows through the outlet 5*b* to dissipate heat from the wall portions 2 along the outer faces of which it flows during its passage through the said channels, or else it is employed in a manner hereinafter described for protecting the inner faces of the wall portions 2 from the burning gases within the combustion space 1. This cool air may be provided in any preferred manner; in the case of combustion chambers used on

aeroplanes the casing inlet **5***a* may be so disposed that fresh air flows directly therein as the plane travels at high velocity.

On the side of the combustion space **1** opposite to that through which the fuel enters the wall portions **2** are spaced from one another so that slot-like passages **6** are formed between them. The trailing extremities **7** of the wall portions **2** between which the passages are formed extend outwardly in the adjacent channel **8** relative to the forward extremities of the adjacent wall portions, thus the passages **6** are disposed transversely of the channel **8** to permit direct and continuous flow of cool air from the inlet **5***a* into the combustion space **1**. These trailing extremities **7** extend rearwardly of the adjacent wall portions to provide overlapping wall portions which constitute short ducts to control the direction of flow of the cool air and insure that it travels parallel with and adjacent the inner faces of these wall portions throughout their length. Thus constantly replenished protecting layers of cool air flow between these wall portions and the products of combustion in the combustion space thereby shielding the said wall portions from the intense heat.

Referring now to Figure 2, the combustion space **11** is confined within wall portions **14** around which an outer casing **15** is provided which has a cool air inlet **15***a* and an outlet **15***b* for the passage of the products of combustion formed therethrough. Between the casing **15** and the said wall portions **14** cool air flows in the direction of the arrows Y. Fuel inlets **12** terminate within the combustion space **11** for the admission of combustible material and are separated from one another by other wall portions **13** arranged in spaced parallel pairs.

These wall portions **13** extend the entire width of the combustion space **11**, project into the said space at their inner extremities, and are flexed intermediately of their length so that their outer extremities lie parallel to the direction of flow of cool air through the casing inlet **15***a*. Between the outer extremities of adjacent pairs of wall portions **13** orifices **19** are formed for the entry of cool air from the inlet **15***a* into passages **18**. This air flows through extensions **16** of the passages **18** between the inner extremities of these pairs of wall portions **13** and is discharged through apertures **17** into the combustion space **11**. This cool air constantly flowing keeps the wall portions **13** relatively cool as it absorbs heat from them during its travel through the passages **18** and **16**, and after its discharge from the apertures **17** it retains the intense heat of the products of combustion spaced from these wall portions and particularly from their extremities adjacent the said apertures which would otherwise be quickly destroyed by heat, since it is of course understood that both these wall portions **13** and the wall portions **14** are again made of sheet metal.

Air inlets **20** are also formed from the inlet **15***a* parallel with the outer extremities of the wall portions **13**, both between some of the latter and also between these wall portions and the wall portions **14** to permit air to flow into the space **11** for purposes of combustion.

MAX ADOLF MÜLLER.

PUBLISHED

APRIL 27, 1943.

BY A. P. C.

M. A. MÜLLER

COMBUSTION CHAMBER FOR GAS-FLOW ENGINES

Filed Nov. 17, 1938

Serial No. 240,907

Fig. 1

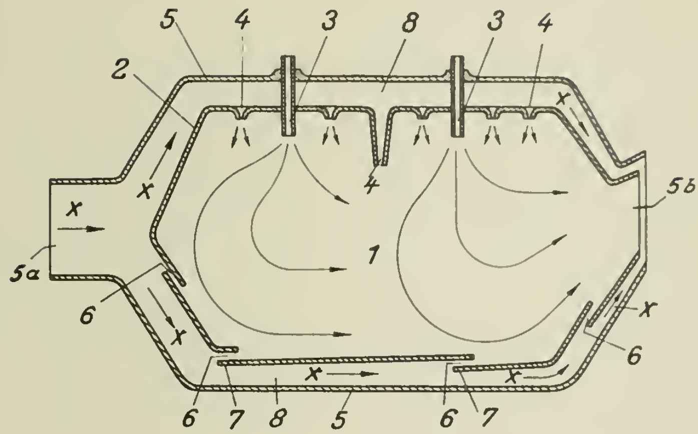
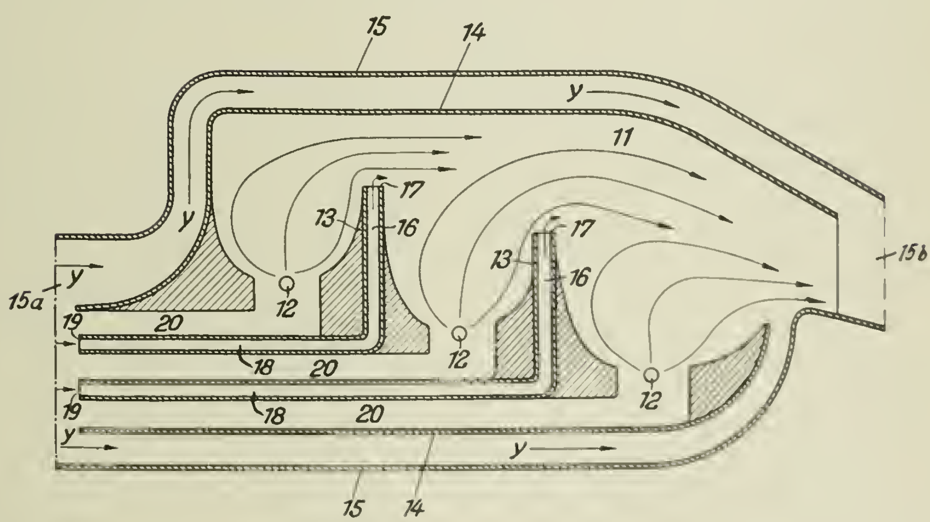


Fig. 2



Inventor:
Max Adolf Müller
by
his Attorney.

Published Apr. 27, 1943

Serial No. 243,050

ALIEN PROPERTY CUSTODIAN

METHOD OF CONVERTING LIQUID HYDROCARBONS INTO HIGHLY COMPRESSIBLE DRY GAS

Robert Arnold, The Hague, Holland; vested in the Alien Property Custodian

Application filed November 29, 1938

The present invention relates to a method of converting liquid hydrocarbons of any chemical composition (of natural or synthetic nature), without employment of high pressure or high temperatures and without any carbon separation, into a highly compressible dry gas (or a gas which is no longer condensable), which is capable of perfectly smokeless, sootless and odourless combustion without any soot and oil coke formation and with formation of waste gases which are completely free from carbon monoxide.

Up to now it has never been possible without employing high pressure or high temperatures to convert natural or synthetic liquid hydrocarbons of any desired chemical compositions, such as light oils, medium heavy oils or heavy oils, without carbon separation into a gas which is no longer condensable and is capable of burning without substantial residues.

The present invention opens up for liquid hydrocarbons of any chemical composition (more particularly aliphatic compounds) new fields of application in various branches of technics in which the use of highly compressible dry gases comes into question as fuel gas, heating gas, driving gas etc.

In the present method liquid hydrocarbons are, before the ignition or the actual combustion or work-producing process, rendered reactive by conversion of the carbon to carbon monoxide or by separation of the carbon from the hydrogen.

The conversion of the carbon to carbon monoxide takes place by the atomised hydrocarbon being drawn into serpentine ducts which are heated to 400–600° C., the liquid hydrocarbon being chemically adulterated or rendered reactive by the atomising air before the conversion.

In this manner a highly compressible dry gas is produced from the liquid hydrocarbon without any carbon separation (or without any soot formation or oil-coke formation) which is capable before the initiation of the ignition or the combustion process of being mixed without recondensation with cold air to form ignition gas, fuel gas or heating gas, which in its combustion process or work-producing process proper is capable of perfectly smokeless, sootless and odourless combustion with formation of waste gases which are completely free from carbon monoxide.

According to one example for carrying out the invention 1 kg. of liquid hydrocarbon of chemical composition $C_{10}H_{22}$ (decane according to its empirical formula) for example is converted within five minutes without any carbon separation into a highly compressible and no longer condensable gas which is capable of perfectly smokeless, sootless and odourless combustion.

For this purpose liquid $C_{10}H_{22}$ is finely atomised in an atomiser of known or suitable construction and is sucked through a 120 nozzle into a cracking plant having a duct 1315 mm. long with an internal width of 8 mm., which after a third of the path divides up into two ducts of 7 mm., at a suction velocity of $^1/_{200}$ of a second.

In the above splitting or cracking plant for hydrocarbons of the decane series the liquid hydrocarbon is converted into a highly compressible gas which can be cooled down with air of an atmospheric outside temperature of itself far below 0° C., without condensing again and can be used as gas for combustion, heating or driving purposes from transportable containers after suitable admixture with fresh air.

Since up to now it has never been possible to burn liquid hydrocarbons irrespective of what empirical formula series without separations of soot and oil carbon as well as carbon monoxide in the waste gases, and since, further, only very few hydrocarbons were highly compressible and no hydrocarbons at all could up to now be converted into a gas which was no longer condensable without high pressure and without high temperatures, the method according to the present invention of converting liquid hydrocarbons of any desired chemical compositions without any formation of soot or oil carbon into highly compressible gas capable of absolutely smokeless, sootless and odourless combustion represents a far-reaching advance in the whole hydrocarbon art and all the practical applications thereof.

The method according to the invention may be carried out in any desired cracking plants which permit of a heating of the duct walls to a temperature of 400–600° C., and through the ducts of which the atomised liquid hydrocarbon is forced through by suction action and is cooled down before the combustion or work-producing process.

The details for carrying the invention into effect, such as length and surface of the duct walls of the cracking plant, the velocity of the suction action, the degree of final cooling down as well as the quantity of atomising air necessary for the adulteration etc., depends on the character of the liquid hydrocarbons used as well as the quantity thereof necessary in each particular case.

The accompanying drawing illustrates diagrammatically and by way of example one mode of carrying the invention into effect.

Referring to the drawing, the liquid hydrocarbon to be treated is atomised in the atomiser A, and the hydrocarbon mist produced is drawn by means of the suction apparatus D through the cracking installation comprising a cracking tube B, which is heated to 400–600° C., by cracking means e. g. an electrical heating resistance C. The hydrocarbon mist converted into dry gas is passed from the suction apparatus D to the cooler E, after which it is compressed by a compressor F into the storage tank G.

ROBERT ARNOLD.

[illegible]

PUBLISHED

APRIL 27, 1943.

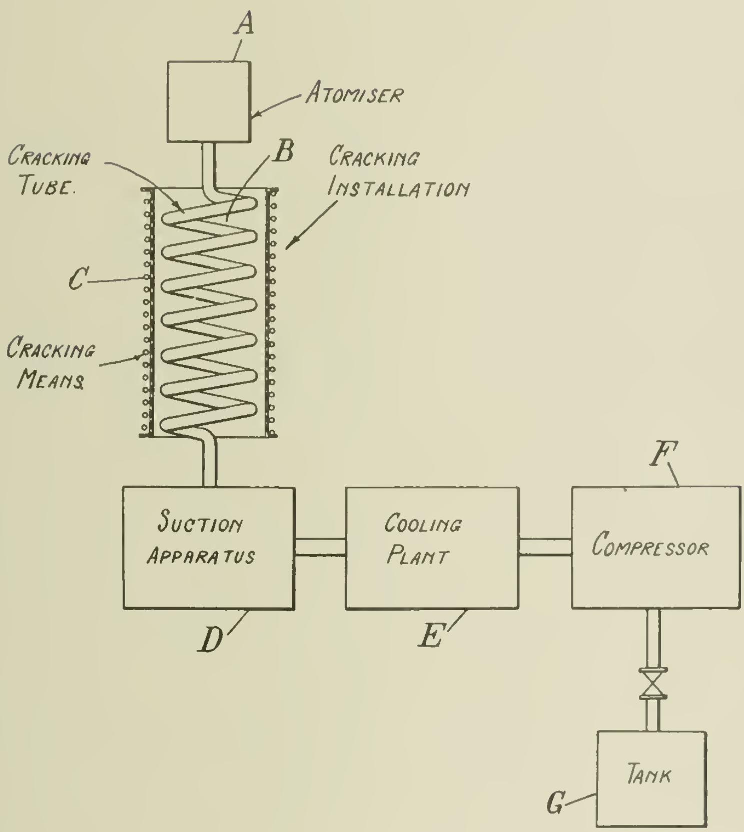
BY A. P. C.

R. ARNOLD

METHOD OF CONVERTING LIQUID HYDROCARBONS INTO HIGHLY COMPRESSIBLE DRY GAS

Filed Nov. 29, 1938

Serial No. 243,050



R. Arnold
Inventor

By: Glascock Downing & Seebold
Attys.

Published Apr. 27, 1943

Serial No. 244,033

ALIEN PROPERTY CUSTODIAN

PROTECTIVE PASTE FOR TOOTH-CEMENTS

Ernst Mühlbauer, Berlin, Germany; vested in the Alien Property Custodian

No Drawing. Application filed December 5, 1938

The usual tooth-cements, especially the silicate cements and the combinations thereof, are sensitive substances, which must be protected from the admission of water or the like, especially saliva, until they have been hardened and the binding has progressed to a certain state, as requisite for the purpose in view.

If the silicate cements and the zinc-silicate cements are, on the one hand, sensitive to water, then, on the other hand, they give off, during the initial state of their hardening, water containing phosphoric acid to the surface of the cement, this water being later on again absorbed, or reabsorbed respectively, and being bound as crystal water. Withdrawing this specific aqueous solution which has only temporarily been separated from the filling body would be detrimental for the development of the properties of the cement. Another type of the tooth cements requires an admission of water immediately at the commencement of the binding, be it even only in the form of atmospheric moisture (breath air).

The dentist endeavors to prevent the premature admission of water (saliva), or the loss of the substance (chiefly water) separated temporarily from the filling body by coating this body with a lacquer, or a varnish respectively, or with wax, but it is very difficult to meet the proper point of time for that contrivance. The operator depends, as regards the chemical composition of the various kinds of cement, and in view of the impossibility to control the hardening and binding-phases of the same, on his feeling, the more, as exterior influences, such as the temperature of the respective room, the moisture of the air, the consistency of the cement paste, and the like, entail considerable changes, in consequence whereof the effects sought to be attained and the quality of the work are often times a play of chance.

It has been a surprise to detect that the above mentioned drawbacks can be overcome very satisfactorily by applying to the freshly deposited and modelled filling body of cement water in the form of an aqueous emulsion of suitable substances, the emulsion having preferably paste-like consistency. First of all oils, for instance wool-fat (adeps lanae) are particularly suited as emulsifying substances, but also aqueous emulsions of earth-nut oil, paraffin oil, olive oil, cod-liver oil, a mixture of olive oil and the yellow or the white of eggs, may be used singly or in combinations. Furthermore, protective colloides of known types, as for instance gelatine, vegetable fats or the like, may be added to the aqueous emulsion in order to prevent a coagulation of the emulsion even if it is of a strongly paste-like consistency.

It is thereby attained that the dilute phosphoric acid coming from the filling body does not get lost, and that the surface binds quicker by reason of the presence of the water from the emulsion, so that the risk of the premature admission of saliva and, thus, the destruction of the filling is practically completely prevented.

As this paste is applied immediately after the filling body has been modelled, that is to say, during that time in which it is completely plastic, the difficulty to choose the proper point of time for applying the varnish or the equivalent therefor is entirely obviated.

The types which require water—although in atmospheric form,—during the hardening and the binding in order to attain the highest development of their useful qualities are affected in the most favorable manner when having been coated with the emulsions stated, so that the useful effect which formerly for instance the breath air had exerted is attained in a materially shorter time.

Emulsions containing from 5 to 40% of water have proved particularly advantageous for the purpose in view.

Some excellently efficacious compositions are stated herebelow by way of example:

Example 1

	Per cent
Wool-fat	70
Water	30

Example 2

	Per cent
Wool-fat	55
Earth-nut oil	20
Water	25

Example 3

	Per cent
Wool-fat	60
Paraffin oil	20
Water	20

Example 4

	Per cent
The yellow and the white of eggs from fowls, consisting of about 24% of animal albumen and fat and about 30% of water	54
Olive oil	46

Example 5

	Per cent
Cod-liver oil	70
Gelatine	1
Water	29

Example 6

	Per cent
Earth-nut oil	40
Cod-liver oil	40
Water	20

The compositions mentioned as examples 5 and 6 are employed with the addition of a commercial emulsifying composition.

ERNST MÜHLBAUER.

Published Apr. 27, 1943

Serial No. 245,052

ALIEN PROPERTY CUSTODIAN

METHOD AND AN ARRANGEMENT FOR THE LONGITUDINAL COVERING OF ELECTRIC WIRES

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Application filed December 10, 1938

This invention relates to a method and an arrangement for the longitudinal covering of electric wires.

The so-called longitudinal covering of electric wires permits as is well known the covering of a plurality of electric wires with insulating material in one operation and consists in the fact that a plurality of electric wires running side by side in one plane are caused to pass through corresponding grooved rolls together with bands consisting of insulating material and supplied from above and below. The longitudinal covering is particularly employed in the manufacture of rubber insulated conductors.

The application of the longitudinal covering in connection with the employment of artificial materials available for some time past on the market presents considerable difficulties. Endeavors had already been made to overcome these difficulties by adding a higher percentage of softening agents, which, however, was not successful. Also the heating of the bands before passing through the grooved rolls could not remove the difficulties owing to the greater tenacity of the artificial substances as compared to rubber. Consequently, it has recently been proposed to dispense with the longitudinal covering in the case of artificial substances and to employ the squirting method, for which purpose a plurality of squirting dies lying in one plane were employed in order to render the squirting method more economical.

The object of the invention is to provide a method, whereby electric wires may be insulated with artificial substances by the longitudinal covering. According to the invention the manufacture of bands of insulating material by means of calenders is combined with the manufacture of sheathings for the conductors by means of grooved rolls to one operation by supplying the bands produced on the calenders directly to the grooved rolls together with the conductors to be covered. By the combination of the two operations hitherto unknown it has been surprisingly possible to manufacture proper longitudinal coverings also from very tenacious artificial substances.

A particularly convenient arrangement for carrying the invention into practice consists in a multistage rolling mill whose initial stages consist of heated calender rolls and whose end stage consists of grooved rolls also heated. It may be preferable to employ a four- or multistage rolling mill in order to heat up the artificial material in a particularly uniform manner, in which case the rolls for the initial stages may also be provided with more or less deep grooves so as to attain a proper meshing of the different rolls with one another.

It is true that the invention may be employed for thermoplastic insulating materials of any description which are suitable for the manufacture of electric wire coverings, i. e., also for the natural insulating materials hitherto employed in the manufacture of longitudinal coverings. However, the particular advantage of the invention consists in the possibility of employing tenacious artificial substances for the manufacture of longitudinal coverings. Such artificial substances are, for instance, the polyvinyl halides with or without re-halogenation, the vinyl mixed polymers and finally also the synthetic rubber hydrocarbons. These artificial materials may be treated according to the invention even without softening agents or by adding small quantities of softeners thereto, which is of particular importance, since the electric properties of the softening agents are inferior to those of the artificial materials. Consequently, coverings made by the squirting method and consisting of mixtures containing 25 to 80% softening agents are less favorable from an electrical point of view than the longitudinal coverings manufactured according to the invention. Furthermore, these longitudinal coverings are more economical owing to the saving in softeners.

An arrangement for carrying the invention into practice is shown by way of example in the accompanying drawing. This arrangement consists of a rolling mill having, for instance, four stages, in which two bands of artificial material are manufactured and supplied from above and below to the conductor 1 to be covered. The rolling mill is designed in as symmetrical a manner as possible and presents the same number of rolls for both bands which are produced above and below the conductors 1 inserted in the central portion of the rolling mill. The rolls 2 and 3 arranged above the conductors 1 form the first stage of the rolling mill on which a band 5 is produced consisting of the material 4 supplied, for instance, in the form of powder. This band is homogenized in the second stage consisting of the rolls 3 and 6 and so prepared in the third stage consisting of the rolls 6 and 7 as to be applied to the conductors 1. The rolls 2, 3 and 6 are plain, whereas the roll 7 is grooved as is the case with the longitudinal machines hitherto employed. The rolls 2', 3', 6' and 7' which produce the band 5' consisting of the material 4' are

correspondingly arranged below the conductors 1. Under the pressure of the rolls 7 and 7' which form the fourth stage the bands 5 and 5' are integrally combined to the covering 8 on the conductor 1.

The width of the rolling mill depends upon the number of the conductors 1 to be simultaneously covered and arranged side by side in a plane. As a rule, the rolling mill is therefore not so wide as the usual calenders. If it is not possible to produce sufficiently homogeneous bands from the material 4, 4' owing to the smaller width of the roll it is advisable either to arrange one or more pair of rolls than is otherwise necessary or to give the bands such a width that they project beyond the row of conductors a greater amount than is the case with the methods hitherto known for manufacturing longitudinal coverings.

Some artificial substances containing particularly polyvinyl chloride have the peculiarity that their good properties as to their strength and elongation, can only be attained if the material is given its final shape at a high temperature, for instance, at 160 degrees centigrade and more. When heating the material to the temperature required an overheating, for instance, even a local overheating may easily occur and cause a thermic decomposition. The invention avoids this disadvantage by the fact that the rolling mill is provided with devices for maintaining a uniform temperature of the material on the rolls. This may be accomplished, for instance, by electrically heating the rolls, for which purpose control devices may be employed, particularly automatic control devices. When heating the rolling mill by steam such control devices may also be employed. Particularly advantageous is the housing of the entire rolling mill so that a strictly uniform temperature prevails therein. A housing 9 is shown schematically in the drawing. The housing is provided at the upper and lower part thereof with hoppers for the material 4 and 4' and the rolls may be inspected by sight glasses or apertures capable of being easily closed. The enclosure 9 may, for instance, consist of a sheet iron housing. However, it may also be provided with walls consisting of material particularly impermeable to heat. Furthermore, heating devices may be arranged in the walls or on their inner side and they may under circumstances be so designed that the rolls need not be heated. The bearings of the rolls may, if necessary, be cooled in order to enable an operation of the rolling mill at a high temperature and pressure of the rolls.

The arrangement of the rolls may be different from that shown in the drawing. The rolls may also be arranged perpendicularly one above the other. In this case the supply of the artificial substance may be effected by the use of guides on the rolls and also by the use of shaking troughs. It is not necessary that the calender rolls be arranged perpendicularly above or below the grooved rolls. It is even possible to arrange the calender rolls obliquely in front of the grooved rolls and under circumstances at such a distance from the grooved rolls that the bands do not run between the rolls for a certain distance.

The bands manufactured on the rolls may be produced of different or at least variegated materials if this is convenient for the manufacture and use of the wires.

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PUBLISHED

APRIL 27, 1943.

BY A. P. C.

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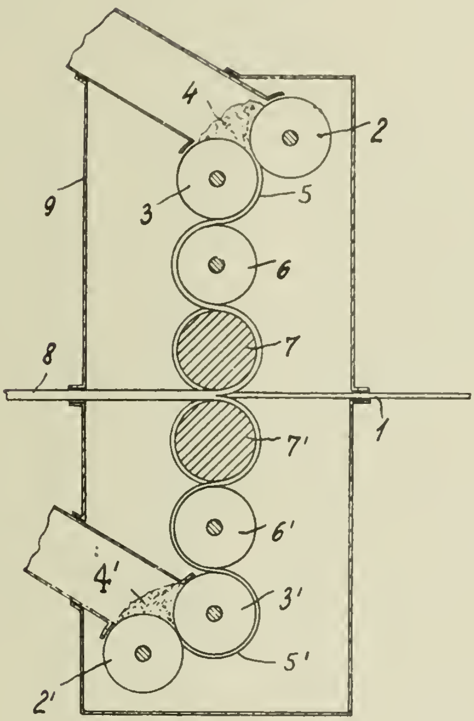
METHOD AND AN ARRANGEMENT FOR THE LONGITUDINAL COVERING OF ELECTRIC WIRES

Filed Dec. 10, 1938

Serial No. 245,052



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Published Apr. 27, 1943

Serial No. 246,223

ALIEN PROPERTY CUSTODIAN

AUTOMATIC MACHINE FOR THE MANUFACTURE OF BOTTLES AND LIKE ARTICLES

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Application filed December 16, 1938

The present invention relates to a machine for the automatic manufacture of bottles, flasks, or other articles made of hollow glass. Said machine belongs to the class of automatic machines provided with a plurality of pairs of parison and finishing moulds which rotate at a uniform speed about a central column and take up glass by suction from a receptacle containing molten glass.

In this general framework, the invention has for its object a machine which is capable of producing a large output, while being of very substantially reduced weight and bulk relatively to the known machines of the same class, which have an equal number of pairs of moulds.

As the capacity of output is directly proportional to the rhythm of the up-takes of glass, that is to say to the speed of rotation of the rotating part of the machine, all the essential original features of the machine according to the invention have been designed and combined to contribute to a common end, which is the construction of a machine having a high speed of rotation, in particular higher than that of the machines of the same class.

In order to eliminate the various physical or kinematic causes which act to retard the speed of rotation of a machine of the above defined class, or to impose an impassable upper limit on said speed, the invention provides a group of characteristic solutions which follow from each other and complete each other so as to make possible the high speed that is necessary for the high output required from the machine.

A first characteristic peculiarity which, in the machine according to the invention, has enabled the speed of rotation to be fundamentally increased, rests on the following considerations which are illustrated by Figs. 1 and 2 of the accompanying drawings.

A parison mould,—belonging to a series of moulds which are evenly distributed about a central column having o as its axis, on a pitch circumference or trajectory p and successively taking up glass from a supply tank or its equivalent l—collects its charge of glass from said tank along the arc e^1—s^1. When the taking up has been completed at s^1, it is necessary for the charge of glass of the mould to cool in the latter until the glass has reached a degree of rigidity which enables the parison to be transferred into the finishing mould without danger of dislocation. A predetermined minimum time therefore has to elapse between the instant when the parison mould is filled and the instant when the parison is released.

Then, a likewise predetermined minimum time is required for said parison to be ready to be subjected to blowing in the finishing mould.

The blowing operation itself requires a predetermined time and also the mechanical operations which restore the parison mould to condition for sucking up a fresh charge of glass.

In the known machines—belonging to the class under consideration—this succession of predetermined duration corresponds to the following arcs on the pitch circumference of the moulds: taking up along the arc (e^1—s^1); cooling the parison in the parison mould along the arc (s^1—u^1); transfer of the parison to the finishing mould, along the arc (u^1—v^1); stay of the parison in the latter, along the arc (v^1—t^1); blowing the parison to its final shape in the finishing mould, along the arc (t^1—z^1). The arc (z^1—w^1) corresponds to the return to conjunction of the finishing mould and of the parison mould.

In the known machines, the mechanical constructions are such that the blowing in the finishing mould has necessarily to be completed before the parison mould has reached the point e^1. In fact, in said machines, the blowing means are part of the parison mould and consequently have to be returned to, or placed in relation with the latter at, the point w^1 before the suction operation begins, that is to say before the parison mould has reached the point e^1.

In this connection, an essential feature of the machine which is the object of the invention consists in the fact that, in each group of moulds, the blowing in the finishing mould is effected by means of members which are not involved in the sucking up of the charge of glass into the parison mould of the group. Thus, the blowing of the parison does not require any member that is lacking in the parison mould when the latter comes into position for sucking up again the charge of glass which is to form the next parison. In the embodiment described hereinafter, blowing is effected by a vacuum action.

Fig. 2 illustrates the distribution of the various characteristic stages along the pitch circumference of the moulds, for the machine according to the invention. The arcs are in this case given the index (2).

In this machine, blowing can continue to be exerted beyond the point e^2—since the blowing operation does not deprive the parison mould of any of the members which are necessary for the action of taking up by suction exerted by said mould from the point e^2—and can even start beyond the point e^2.

In the example of Fig. 2, blowing can terminate at z^2, that is to say beyond the point s^2. Now, owing to the fact that the duration of blowing is constant, the arc (s^2—u^2—v^2—t^2) described by each of the pairs of moulds from the point s^2 (which marks the end of the take-up) to the point t^2 (which marks the beginning of the blowing) may be larger than in the known machines (arc s^1—u^1—v^1—t^1).

As the time for travelling through these two different arcs must be the same, the speed of rotation must be higher in the case of the new machine, which is equivalent to an increase of output.

In such a machine which has to operate with a high speed of rotation of the rotating part, the determination and the adjustment of the instant at which the blowing of the parison in the finising mould has to begin, specially form decisive factors for the regularity of manufacture.

It is therefore necessary to have means available which enable the position of the point t^2 to be fixed at will and very simply, for blowing a parison which is intended to form a bottle or a flask of predetermined dimensions. This position of the initial point of blowing is liable to vary within relatively wide limits, according to the requirement of the successive manufactures.

The experimental determination of the initial point of blowing is particularly important in the case of high speed machines since, in the latter, the results of a premature or a late start of the blowing are of a nature such as to impair very substantially the efficiency of the blowing operation.

In this respect, a second essential feature of the invention, in close relation with the speed factor, consists in a combined group of adjusting means for distributing the vacuum to the various finishing moulds.

Said adjusting means enable the point of origin of the blowing in said finishing moulds to be displaced within the wide limits required to enable the machine to be adapted instantly to the various changes of manufacture.

According to the invention, two factors for adjusting said initial point of blowing are provided, one enabling the rough setting of the adjusting to be effected by a substantial angular displacement of the starting point of the blowing, the other enabling the adjustment of the best position to be accurately completed.

For this purpose, in each group of moulds, the finishing mould is surrounded by two vacuum supply pipes and is connected to the latter by two respective supply cocks which can be alternately opened and closed, said pipes accompanying the rotation of the finishing mould which they supply and terminating, towards the central part of the machine, by orifices which circulate along a fixed supply slot which is connected to the vacuum reservoir and extends along a certain arc about the general axis of rotation of the moulds.

To this arrangement—which enables the initial point of blowing to be systematically and instantaneously displaced, by the simple alternate actuation of the cocks, between two extreme positions which are separated by an arc corresponding to the angular distance between two groups of moulds—is added a second adjusting control by means of which a balance of angular displacement can be given the point of origin of blowing. Said second adjusting control acts by means of an angular displacement of any desirable amplitude, which is communicated to the member in which is provided the slot forming a vacuum supply valve.

The device as a whole therefore permits of any combination as regards the beginning of the blowing in the finishing moulds, which beginning forms an important factor of the manufacture.

A third feature of the machine, which also contributes to make possible a substantial increase in the speed of rotation and in the capacity of output, consists in the considerable reduction of the pitch circle forming the trajectory of the centres of the moulds, with respect to machines of the same class.

In fact, it is known that the speed of rotation—and consequently the efficiency of a machine of this kind—is limited by the effects of centrifugal force which, being exerted on the parisons that are suspended on the ring moulds, is liable to cause the deformation or the untimely displacement of said parisons outside the trajectory they should normally follow. The considerable reduction of the diameter of the pitch circle of the moulds therefore enables the effects of centrifugal force to be attenuated very substantially and consequently makes it possible to increase considerably the speed of rotation.

In the machine according to the invention, this result is obtained in practice under the following conditions:

(*a*) The radius of opening of the moulds, that is to say the distance from the axis of the parts of the mould to the pivotal axis of said parts, is extremely short, so that the displacement of said parts during their opening movements is angularly reduced, thereby enabling, for a given transverse diameter of the machine, the latter to be provided with a greater number of mould systems.

(*b*) Concurrently with the previous arrangement of moulds having a short radius of opening, the construction of the machine is such that no member is interposed between two groups of adjacent moulds, thereby procuring the minimum peripheral bulk.

(*c*) No intermediate member exists between the cams which generate the upward and downward movements of the parison moulds and the parison mould carrier slides which are subjected to the action of said cams. Said slides, which are of very reduced width, directly carry the rollers that actuate them.

Owing to these three arrangements, at the same time as the production is increased, the cost of constructing the machine is reduced to a considerable extent relatively to comparable machines belonging to the same class.

Furthermore, owing to the fact that the angle corresponding to the suction of the glass in the take-up receptacle is constant, the arc described by the parison mould in dipping into the glass is proportional to the diameter of the pitch circle of the moulds. The substantial reduction of said diameter will therefore enable the length of the suction arc to be correspondingly reduced. Consequently, it will be possible to decrease in a corresponding manner the surface of the glass exposed to the atmosphere. In the case of a rotating tank, the diameter of same can be reduced in the same proportions.

A fourth feature of the machine relates to the faculty possessed by same for producing, during the same cycle of manufacture, articles of different dimensions and shapes, some moulds being, for example, used for the manufacture of bottles,

others for flasks having more reduced dimensions.

When such a mixed manufacture is started, it is necessary to effect the adjustments which compensate the variations of height of the various parison and finishing moulds that are put into use on the machine.

Said adjustments are obviously dependent on the suction members through which the take-up of glass may be effected.

Now, in the known machines, the adjustment in question requires an intervention on the parison mould carrier. In the machine according to the invention, the adjustment in height is not effected on the mould carrier member, but on a sliding tube which is adjustable in said member and against which the ring mould is adapted to rest, so as to determine the position of origin of the latter, whereas the tube furthermore serves for establishing the communication of the ring mould and of the parison mould with the vacuum reservoir. For this purpose, said tube is moved, for its adjustment in height, in a fluid-tight chamber of the parison mould carrier member, which chamber communicates with a vacuum inlet valve.

In practice, it therefore suffices, the parison mould being mounted on the mold carrier, to bring the tube into the predetermined position corresponding to the type of said mould, for the adjustment to be obtained immediately.

A fifth feature of the machine relates to the fact that, owing to the closeness of the groups of moulds—which has enabled the substantial decrease to be obtained in the pitch circumference of their centres—said moulds follow each other at close intervals in the supply tank. It ensues that constantly, at least one parison mould touches the glass in the supply tank and that, under these conditions, it would not at any instant be possible to move the machine backwards, said machine being only able to move away horizontally from the supply tank.

In view of the fact that, under certain circumstances, it is indispensable to move the machine away from the tank, the invention includes a special device for this purpose, whereby the withdrawal of the machine can be obtained without running the risk of a part of the latter, in particular a parison mould, striking the wall of the tank during said withdrawal.

These characteristic devices—which for the above reasons form an indispensable complement of the high output machine in question—act to prevent the downward movement of the parison moulds at the instant when they should normally effect their dip into the tank.

A sixth characteristic peculiarity of the machine according to the invention relates to the cooling of said machine.

It is known that it is always necessary to cool the moulds of a bottle-making machine and that this necessity is more particularly imperious for a machine which, as it rotates at the maximum speed, takes up a considerable tonnage of hot glass.

However, as it is a matter of a machine belonging to the class under consideration, that is to say in which all the moulds rotate about a vertical axis, it is necessary to contend, not only with the heating of the moulds, but also with that of the entire central portion which contains the mechanisms determining the take-up, the transfer and the transformation of the glass, and is surrounded by a relatively large number of moulds, the mean temperature of which is of the order of 500° C. This heating of the central portion of the machine by conductivity and by radiation is more important as the dimensions of the machine are relatively reduced with respect to the number of moulds it carries.

The carrying out of the cooling in the machine according to the invention, has therefore set a particular problem, owing to the compact structure of said machine and to the concentration of heat of which it tends to be the seat because of the proportionally large mass of hot glass it takes up and transforms in each unit of time.

The invention provides, for this purpose, means for cooling the actual body of the machine, said means chiefly consisting in the creation of a circulation of cooling air inside a central drum which carries or encloses the most exposed mechanisms, so that the machine thus acquires the aeration which is indispensable and sufficient for the complete safety of its mechanical operation.

Figs. 3 to 7 of the accompanying drawings show a machine possessing all the above defined features.

Figs. 3, 4 and 5, which are to be joined together along the section lines indicated in Roman figures, show as a whole a vertical section of said machine through the plane determined by the axis of the machine and by the axis of a parison mould in the take-up position in the molten glass.

Each of Figs. 6 and 7 assembles a number of views in horizontal section, these sections being staged along planes projected at B—C—D . . . H—I—J in Figs. 3 to 5.

The correspondence between these sectional views and their line of projection on the vertical plane of Figs. 3 to 5 is established by the same reference letters B—C—D . . . H—I—J.

The view A of Fig. 6 is a plan view, seen from the top, of the machine limited to a pair of parison moulds vertically above the supply receptacle.

Fig. 8 shows the diagrammatical horizontal section of a device for adjusting the initial instant of blowing in the sequence of finishing moulds.

Fig. 9 is a view along the plane projected at x—x in Fig. 8.

Fig. 10 is a view along the plane projected at y—y in Fig. 8.

The rotating part of the machine is arranged on a base forming a carriage **1**, and receives a continuous rotary movement from an electric or other motor, through the intermediary of a shaft **2**, a worm **3**, a worm wheel **4**, a shaft **5**, a pinion **6**, and finally a gear wheel **7** fixed to the base of the rotating part.

The latter is composed of three assembled main parts: the drum **8** which rests on the ball thrust bearing **9**, the intermediate plate **10** and the upper plate **11** which is connected to the former, **10**, by braces **11**ª evenly distributed at the periphery of said plates.

The structural rotating part thus composed rotates about a central column **12** which is fixed on the frame **1** and carries the various cams which actuate the mechanism of the machine.

A plurality of groups of similarly formed moulds (parison mould—finishing mould), are evenly distributed at the periphery of the rotating parts. In the example of the drawings, the machine is provided with a number of groups of moulds equal to ten.

Each group comprises a parison mould **13**—and all the mechanisms appertaining thereto—and a

finishing mould 14 with all its accessory members.

In each of said groups, the parison mould and the finishing mould are arranged in the same vertical plane, the first above the second. Between the parison mould and the finishing mould, an empty space is provided to enable the supply tank 15, in which the parison moulds successively take up their charge of glass by suction, to pass and to rotate.

Each of the parison moulds 13 rests on a separate mould-carrier 16 which is pivoted about a long hollow pivot 17 carried by a vertical slide 18 that is guided on two fixed parallel rods 19.

An upward and downward movement is imparted to the slide 18 at the opportune instants by means of a roller 20 rolling on an outer slope 20^a of a cam-drum 21 which is itself fixed on the central column 12.

This downward and upward movement is intended to cause the base of the parison mould 13 to dip in the glass of the tank 15 for the purpose of filling said mould and of lifting same over the wall of the tank after the filling is completed.

Fitted in the upper part of the parison mould 13, the opening parts of the ring mould 22 are arranged inside a slide 23, the latter being carried by two parallel rods 24 which are guided in the slide 18. Said parallel rods are connected to a lever 25 by connecting rods 26.

The lever 25, which is pivoted at 25^a on the upper plate 11 of the machine, receives an oscillating movement which is imparted to it by a cam slope 25^b arranged outside the cam-drum 21. The movement is transmitted by a roller 27 carried by a slide 28 which is guided on the hollow pivot 17 and transmits its movement by means of the connecting rods 29.

The vertical reciprocating movement which is thus imparted to the ring-mould carrier is intended, at the opportune instant, to lower vertically the parison which issues from the parison mould and introduce said parison into the previously opened finishing mould, then, after said parison has been delivered to the finishing mould, to return the empty ring mould to its original position.

Said position, which is a function of the height of the parison mould under consideration and consequently of the size of the bottle to be manufactured, can be adjusted by an appropriate displacement of the rods 24 in the slide after having released them from the connecting rods 26, but it is also controlled by a tube 30. The ring mould is closed about the lower end of said tube which is fixed in the position suitable for a given parison mould by means of a rod 31, the latter being provided with a screw sleeve 31^a which enables the height of the tube to be adjusted.

The tube 30 also fulfils a second function, viz.: placing the ring mould and parison mould assembly in communication with the vacuum.

For this purpose, said tube 30 is lodged in a fluid-tight cavity 30^a of the slide 18, which cavity communicates with a valve 32 through the intermediary of the tube 33 and of the hose 34. The adjustment in height consists in simply moving the tube 30 vertically inside this fluid-tight housing. After the adjustment has been completed, during the rotation of the machine, the valve 32, which is actuated by a slope arranged on the drum 21, serves in particular for effecting the suction of the glass into the parison mould 13.

Inside the tube 30 is lodged a rod 36 which is terminated by the usual mandrel 35. Said rod is actuated by another slope 36^a of the drum 21, by means of a lever 37, connecting rods 38 and a bell crank lever 39.

In order to effect the cutting of the glass after same has been sucked into the parison mould, a chisel 40, which is fixed at the end of an arm 41 pivoted on a shaft 42, receives a circular movement from a slope 43 of the cam-drum. The lever 44, the toothed quadrant 45 and the pinion 46 which is keyed on the shaft 42 are the members which transmit said movement. After having cut off the tail of the glass at the base of the parison mould 13, the chisel is returned to its starting position by a retracting spring 47.

The parison mould is opened and closed at the opportune instants by the action of two connecting rods 53 which are pivoted on each of the parts of the mould-carrier 16 and on a slide 49 which is adapted to slide on a bar 50.

The cam disc 51, with grooves 51^a, are, together with the roller 52, responsible for this movement.

The connecting rods 53 are provided with a cardan joint so as to yield to the upward and downward movements of the parison mould.

In each of the groups of moulds, the finishing mould 14 which is in two parts, is arranged in a mould-carrier 54 composed of two parts which open about a pivot 55. Its opening and its closing are effected in the same manner as those of the parison mould and the mechanism for this purpose is composed of the same elements, viz.: the slide 49^a and the bar 50^a. Contrary to the mounting of the connecting rods 53, the connecting rods 56 are not necessarily fitted with a cardan joint.

At the required time and by means of the roller 52^a, the groove 57 of the cam disc 58 produces the opening and closing movements of the mould.

The base of the finishing mould 14 closes about a bottom 59 carried on an arm 60 which is pivoted at 61. Said arm is provided with a roller 62 compelled to roll on a disc 63 which is itself fixed on the frame. At a predetermined spot on this raceway, a depression of appropriate depth causes the tipping of the bottom 59 and consequently that of the bottle contained in the mould.

In the machine under consideration, the blowing of the bottle, or other similar article made of hollow glass, is effected by means of a vacuum.

Such blowing by means of a vacuum has already been used, in particular in the machines which were the object of U. S. Patent No. 1,946,411 of February 6, 1934.

A similar arrangement can be obtained, and is moreover illustrated in the accompanying drawings in a machine according to the present invention. Reference is made to the fact that the bottom 59 of the finishing mould is provided with grooves, in this case 59^a, which communicate, on the one hand with a conduit 59^b connected to the vacuum reservoir, on the other hand with grooves 59^c provided in the contiguous faces of the two parts of the finishing mould. When the latter is closed, the action of the vacuum for blowing the bottle takes place through this set of grooves and conduits and through the joint between the bearing faces of the mould parts.

On the other hand, the disc 58 carries a second cam groove 64 which is intended to effect the opening of the ring mould 22.

This latter, in which the parison is suspended, engages, at the end of its downward travel, in two pins 65 carried by arms 66 which are rigidly fixed on two parallel shafts 67. Said shafts re-

ceive a slight rotary motion through connecting rods 68 extending from the slide 69 which is actuated by the cam groove 64. Consequently, at the required instants, the pins 65 move apart and cause the two parts of the ring mould in which they are engaged to undergo the same movement. The ring mould consequently leaves the parison, which it supports, in the perviously closed finishing mould and can then return empty to its starting position.

The machine which has just been described operates as follows:

The groups of moulds 13—14 on the one hand, the tank 15 on the other hand, rotate respectively and in opposite directions, with a uniform rotary movement, at the same linear speed, like two intermeshing gear wheels.

As soon as the parison mould 13, rotating in the direction f, has passed over the wall of the tank 15, it moves downwards in the latter, touches the glass and fills. Then it moves upwards and the chisel 40 cuts off the tail of the glass by sliding against the base of the parison mould. The glass which has been taken up then remains enclosed in the mould, while the mandrel 35—which has previously moved downwards—moves upwards, having thus prepared a start for the blowing.

After a certain angle of rotation, the parison mould opens and the parison remains suspended on the ring mould 22. The latter is lowered while the finishing mould 14 opens; the parison is introduced between the open parts of the latter.

The parts of the finishing mould then close about the parison and the ring mould releases the latter by opening. Then, the ring mould returns to its starting position, the parison mould closes and the mandrel moves downwards whereas the group has returned adjacent the tank.

During a fresh suction which is effected by this same parison mould, the previous parison, which is enclosed in the finishing mould, is blbwn and is ready to be ejected as soon as the parison mould which corresponds to it opens to enable a fresh parison to take the place of the bottle which the bottom of the finishing mould will have tipped out of said mould.

It must be observed that each group of moulds successively effects a similar cycle of operations to that which has just been described.

As was explained at the outset, the machine according to the invention is provided with means enabling the initial instant of the blowing in each of the finishing moulds to be accurately adjusted.

Said means, which are illustrated in Figs. 8 to 10, comprise a ring 89 having the same rotary movement as the moulds and communicating, through evenly spaced radial pipes a, with the respective finishing moulds of each group. Each of the pipes a is connected by means of nipples b to the hollow shaft 61 which the conduit 69[b] places in communication with the grooves 59[a]—59[c] of the finishing mould and of its bottom. Between each of the pipes a and the adjacent finishing moulds, are interposed cocks c on the nipples b. The evenly divided ring 89 rotates on a fixed disc 70 which carries a slot 70[b] which extends over an arc x—y representing the angle corresponding to the duration of the blowing. Said slot is in constant communication, through a hole 70[a], with the inside of the column 12 which forms the vacuum reservoir. Each of the bores g terminating the pipes a towards the centre, passes over the slot 70[b] and thus places one or the other of the finishing moulds supplied by the corresponding pipe a in communication with the vacuum, according to whether the open cock c precedes or follows said pipe. For example, in the case of the finishing mould 14[a], blowing will be effected with an advance or with a retard corresponding to the angle X between two consecutive pipes a, according to whether the open cock is c^1 or c^2.

It is therefore possible, during the manufacture, to vary very simply, by merely operating the cocks, the beginning of the blowing in the finishing mould by advancing or by retarding said beginning a considerable angle, in this case (machine having ten groups of moulds) equal to 36°.

Furthermore, the disc 70—which is fixed during operation—can be adjusted by means of an angular displacement which is imparted to it by a toothed pinion 70[c] which is driven from the outside of the machine by any suitable means, so that all the blowing operations can be simultaneously advanced or retarded with great accuracy.

As explained above, another feature of the machine consists in means which enable the downward movement of the parison moulds to be prevented at will at the instant when they should normally effect their dip.

For this purpose, horizontal slides 71, which are equal in number to the groups of moulds, are arranged on the intermediate plate 10, in the same vertical plane as the axis of the corresponding slides 18 and are adapted to engage in a notch 72 of said slides before same have started their downward movement which is effected by the action of gravity.

The movement of each slide 71 is caused by a corresponding roller 73 on which may act, if necessary, a slope portion 74 mounted on the fixed cam-drum 21; said slope only acts on the slide when it has moved down below its normal inoperative position.

In normal operation, the roller 73 of each slide 71 circulates below said slope. When it is desired to prevent the parison moulds from dipping, the shaft 75 is acted on from the outside of the machine and the eccentric knob 76 of said shaft causes the rod 77 to move upwards and the slope 74 to move downwards by means of the lever 78 and of the rod 79, at the end of which said slope is fixed.

It is obvious that in order to prevent the downward movement of the parison moulds, the slope 74 is moved downwards before the roller 73 belonging to one of the heads of the parison moulds reaches it. All the heads are successively locked in their upper position by the engagement of the nose of their slide 71 in the corresponding notch 72.

The withdrawal of the slide 71 is effected beyond the dipping position of the slope 80 of the cam-drum 21. Said slope in its turn acts in the opposite direction on the roller 73. Each of the supports 18 will therefore be automatically released and will be re-engaged at each revolution until the slope 74 has been raised.

It will therefore be possible to move the machine away from the furnace at any instant, both during the rotation of the moulds and during the phases when the latter are stationary.

The cooling of the machine takes advantage of the drum 8 in which air is driven through a pipe 81 and a conduit 82 provided in the frame. A resilient nozzle 83 ensures the joint between these two parts. The air penetrates into the drum 8

through openings 84 and issues from same through a circular series of openings 85 whence it is directed on to the parison and finishing moulds through a series of nozzles 86 and 87. As it passes through the drum, the air circulates over all the mechanisms which are contained in the latter and prevents or limits their heating. A metal plate 88 closes the upper part of the drum 8. Said plate may be provided with suitably arranged openings so that the air which escapes therefrom also cools the upper region of the machine, its being observed that the latter is moreover less liable to become excessively heated.

EMILE ROIRANT.

PUBLISHED

APRIL 27, 1943.

BY A. P. C.

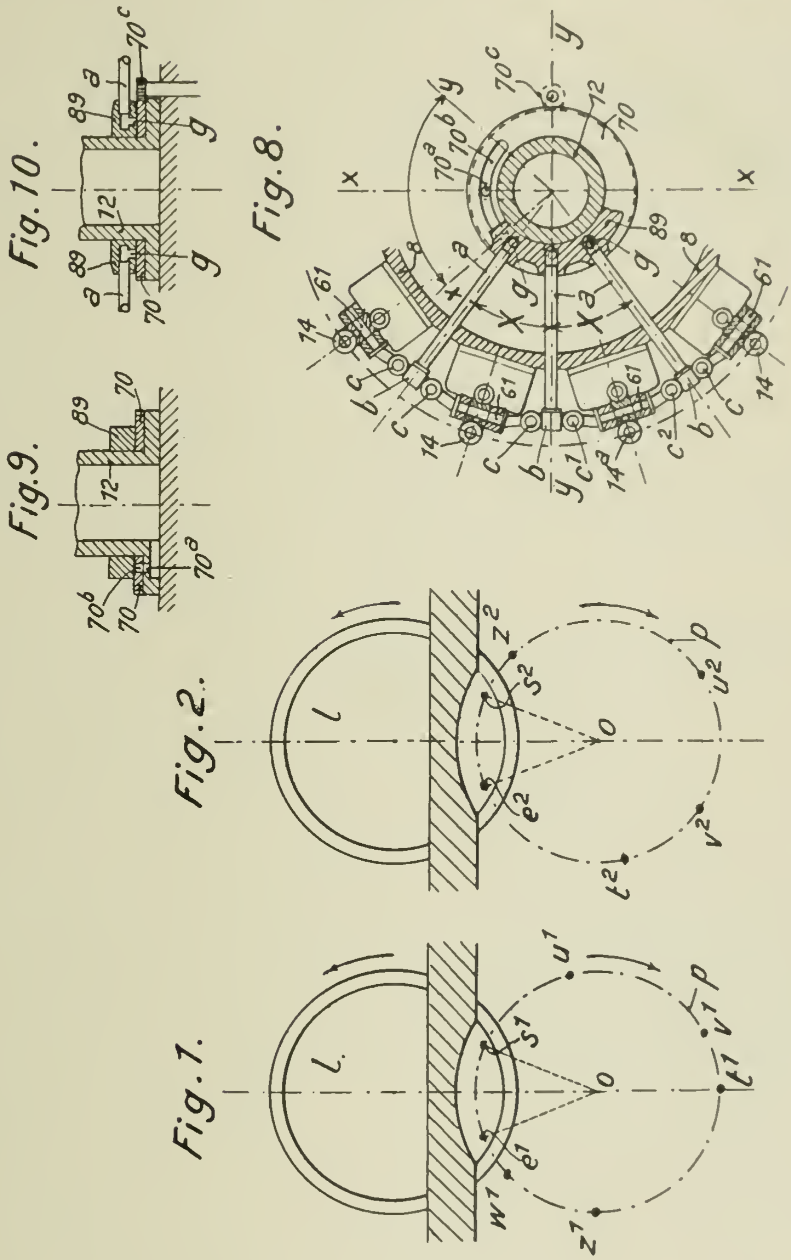
E. ROIRANT

AUTOMATIC MACHINE FOR THE MANUFACTURE OF BOTTLES AND LIKE ARTICLES

Filed Dec. 16, 1938

Serial No. 246,223

6 Sheets-Sheet 1



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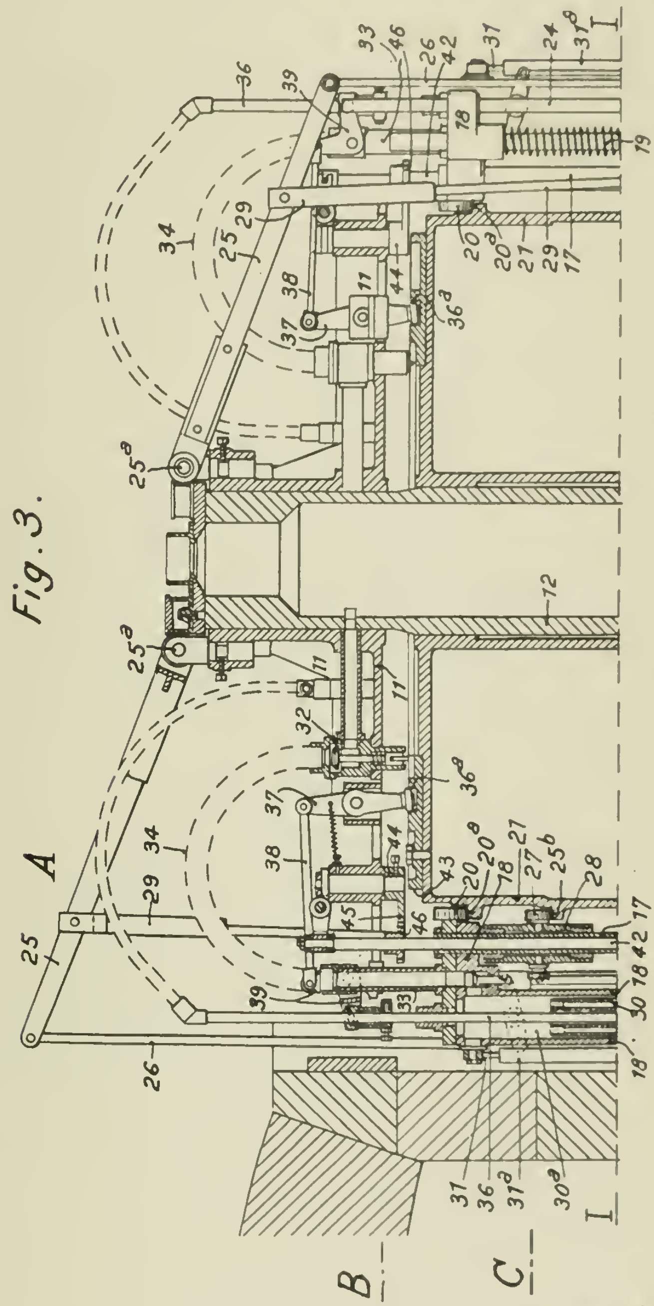
AUTOMATIC MACHINE FOR THE MANUFACTURE
OF BOTTLES AND LIKE ARTICLES
Filed Dec. 16, 1938

Serial No.
246,223

6 Sheets-Sheet 2



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AUTOMATIC MACHINE FOR THE MANUFACTURE
OF BOTTLES AND LIKE ARTICLES

Filed Dec. 16, 1938

Serial No.
246,223

6 Sheets-Sheet 3

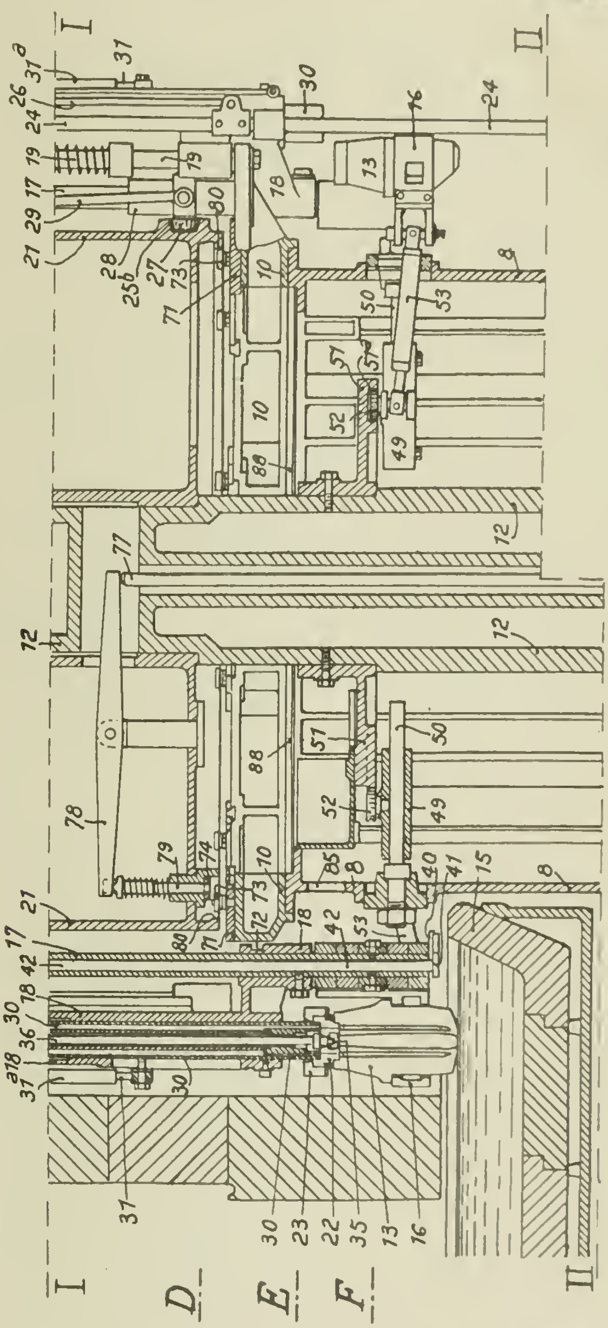

Fig. 4.

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PUBLISHED

APRIL 27, 1943.

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AUTOMATIC MACHINE FOR THE MANUFACTURE
OF BOTTLES AND LIKE ARTICLES

Filed Dec. 16, 1938

Serial No.
246,223

6 Sheets-Sheet 4

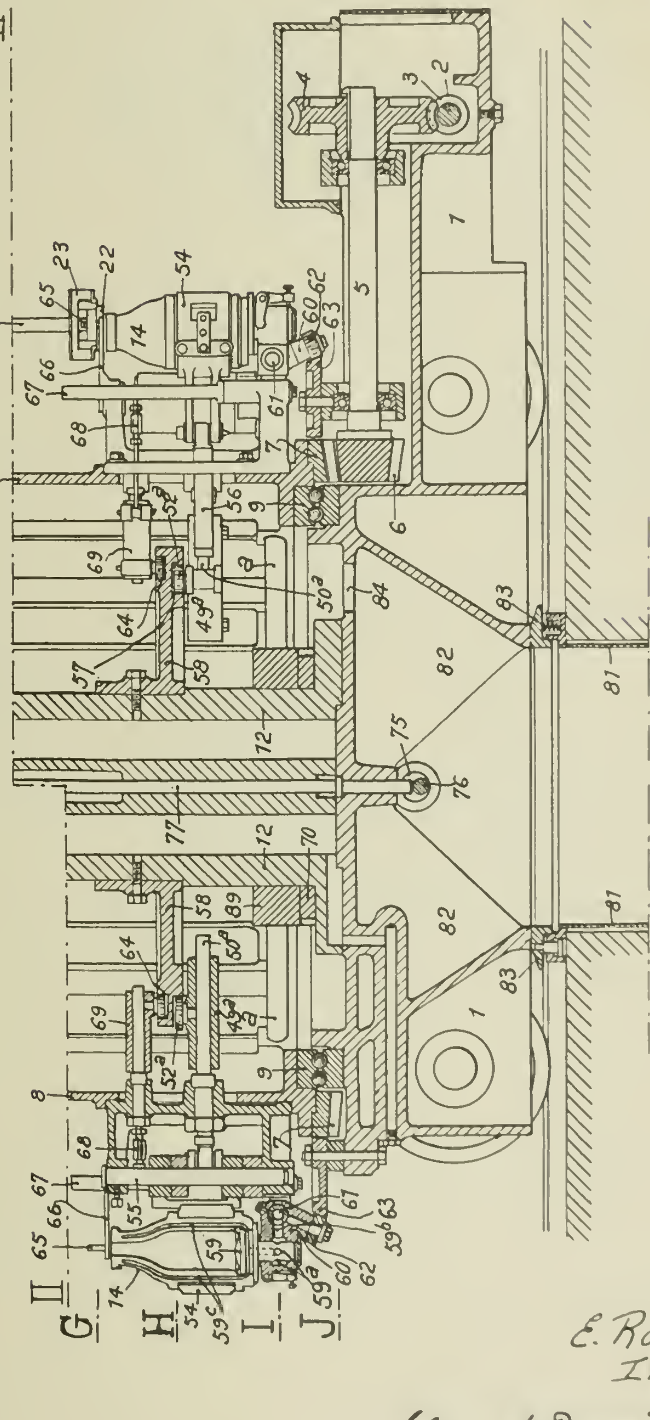

Fig. 5.

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AUTOMATIC MACHINE FOR THE MANUFACTURE
OF BOTTLES AND LIKE ARTICLES
Filed Dec. 16, 1938

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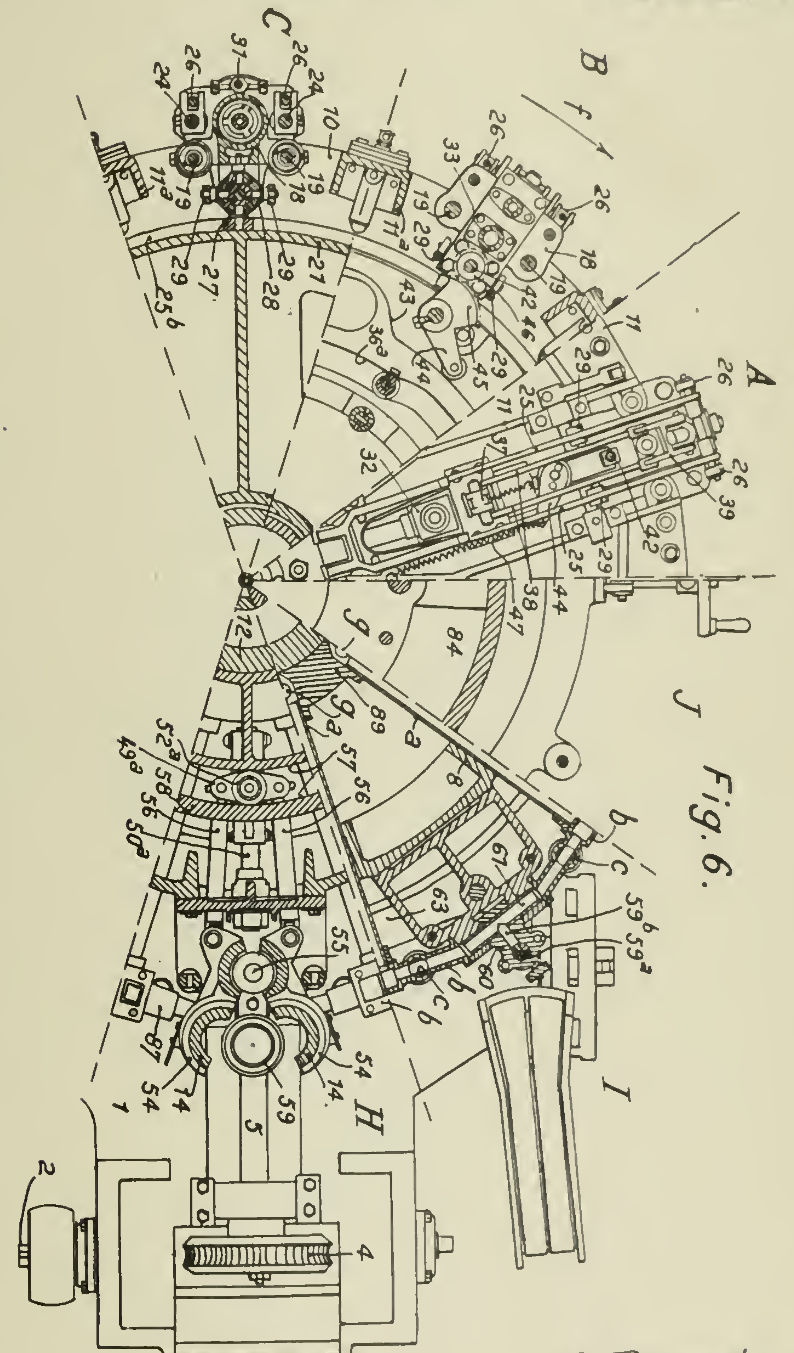
246,223
6 Sheets-Sheet 5



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AUTOMATIC MACHINE FOR THE MANUFACTURE
OF BOTTLES AND LIKE ARTICLES

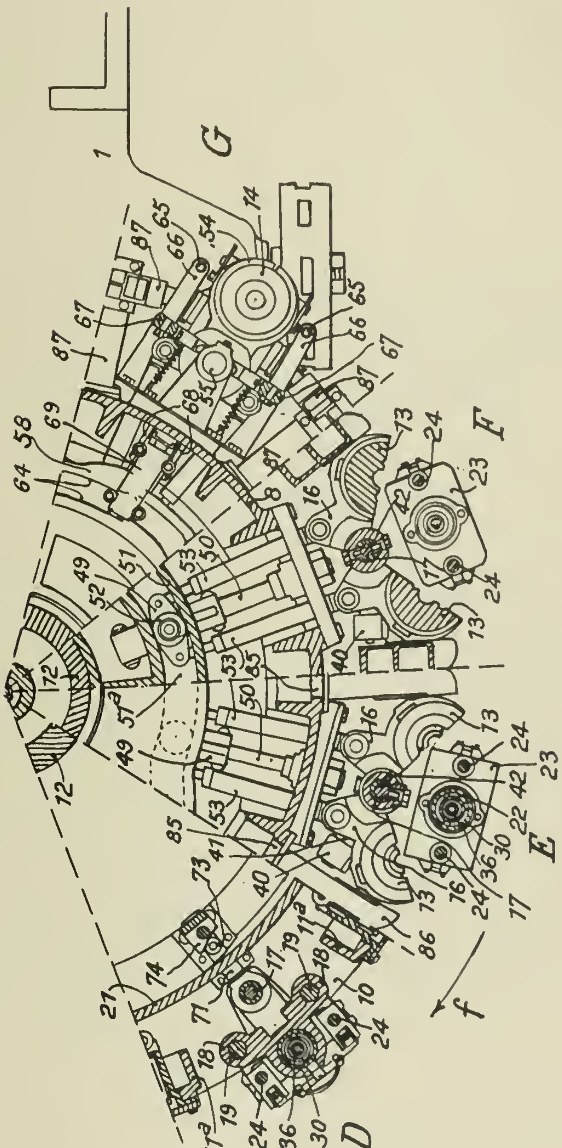
Filed Dec. 16, 1938

Serial No.

246,223

6 Sheets-Sheet 6

Fig. 7.



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Published Apr. 27, 1943 Serial No. 249,246

ALIEN PROPERTY CUSTODIAN

METHOD FOR SQUIRTING ARTIFICIAL SUBSTANCES ONTO WIRES, TUBES, INSULATED CONDUCTORS, CABLES AND OTHER SHAPES

Hans Müller, Berlin-Wilmersdorf, Germany; vested in the Alien Property Custodian

No Drawing. Application filed January 4, 1939

The invention relates to a method for squirting artificial substances onto wires, tubes, insulated conductors, cables and other shapes. In this connection polymers or mixed polymers containing vinyl chloride, acrylic acid and butadiene with or without softening means are particularly employed for the production of protective or insulating coatings.

The method hitherto known for producing protective coatings presents the great drawback that a more rapid cooling of the coating applied in a hot state takes place in the adjacent portion of the protective coating owing to the dissipation of heat at the contact point between the protective coating to be applied and the squirted body, whereby internal stresses, even small cracks are caused in the surface of the coating in direct contact with the body to be squirted so that the mechanical and electrical properties as well as the life of the coating are considerably impaired. This drawback is removed according to the invention by heating the body to be squirted—before applying the protective coating thereto—to the same or substantially the same temperature as the artificial substance to be applied in a hot state. By the method according to the invention a greater mechanical and electrical strength as well as a longer life of the protective or insulating coating is attained. Tests have shown that, for instance, when manufacturing a copper or aluminum conductor to be squirted with polyvinyl chloride or a mixed polymer containing vinyl chloride a better result is obtained if the conductors are preheated to the temperature of the substance to be applied before the same enter the squirting machine.

HANS MÜLLER.

Published Apr. 27, 1943 Serial No. 249,348

ALIEN PROPERTY CUSTODIAN

METHODS AND APPARATUS FOR DETERMINING COMBUSTIBLE GASES IN GAS MIXTURES

Reinhold Weber, Kassel Kirchditmold, Germany; vested in the Alien Property Custodian

Application filed January 4, 1939

This invention relates to a process and apparatus for the quantitative determination of combustible gas in gas mixtures, more particularly in soil gas for exploration of deposits containing hydrocarbons according to German Patent Specification No. 567,698.

As stated in German Patent Specification No. 573,579, the process consists in burning any hydrocarbons or combustible gases present by means of an electrically heated catalytic wire in combination with a galvanometer in the electric circuit of the heated wire, to measure the variations in the resistance of the wire caused by the combustion. Whilst it has already been suggested to employ a ballistic galvanometer in such methods, according to the present process an ordinary highly sensitive galvanometer is employed.

In the method described in German Patent Specification No. 573,759 the soil gas is introduced in a quiescent condition into the reaction chamber containing the catalytic wire. In this procedure, certain disadvantages are encountered, therefore, according to the present invention the soil gas is caused to flow past the catalytic wire whereby any hydrocarbons or other combustible substances present are burned. Of course, the same electrical measuring devices can also be used with gas mixtures in a quiescent condition.

In German Patent Specification No. 573,759 it has been shown possible to use a bridge system. This invention utilizes this known idea in that the catalytic wire forms one arm of a Wheatstone Bridge system.

In contradistinction to the known methods, according to the present invention the soil gas is measured by catalytic combustion by means of the catalytic wire twice, firstly in that it is caused to flow past the catalytic wire in the unaltered state, and secondly, it is caused to flow past the catalytic wire after the hydrocarbons or other combustible gases are removed from the mixture, the resistance of the wire being measured in each case, and the difference in the resistance of the catalytic wire during both measurements, serves as a measure of the amount of hydrocarbons or other combustible substances present in the soil gas.

By this means, in addition to a particularly simple and convenient construction of the device, an absolute comparison of the presence of hydrocarbons or the like is possible.

This feature is particularly important as comparison measurements are always necessary in catalytic methods for the determination of hydrocarbons.

In the case of measurements of soil gas, atmospheric air cannot be used for comparison as the soil gas usually has a different composition to atmospheric air and would, therefore, give different value to the resistance of the catalytic wire, which would give rise to wrong measurements. Also, variations caused by different moisture and carbon monoxide contents of the soil gas at different points are not taken into account.

The process, which completely obviates all these errors, is preferably carried out by aspirating the soil gas before measurement in the unaltered state through the reaction chamber, without switching in the catalytic wire into a receiver, from which after switching in the catalytic wire it is fed through the reaction chamber, whilst in the second case the soil gas is passed over the fully heated catalytic wire in the first passage whereby any hydrocarbons present are burned, so that during the second passage of this air from the container through the reaction chamber, the gas freed from hydrocarbons is measured.

When switched in, the catalytic wire is preferably heated so that its temperature is about 1000°C. so that all hydrocarbons or other combustible substances present in the soil gas are actually burned. It is also preferable that the aspiration and respiration of the soil gas into and out of the receiver is effected by raising and lowering a separate vessel filled with mercury.

The invention also relates to a suitable construction of a device for carrying out the process.

In the drawing one constructional form of a device according to the invention is illustrated in diagrammatic form,

Fig. 1 shows the electrical system.

Fig. 2 shows the apparatus for receiving and measuring the soil gas.

In Figs. 1 and 2, the reaction chamber is indicated at M. It consists of a tubular casing with two sealed covers S and S' between which the catalytic wire 1 is held in a cartridge-like container (not shown in the diagrammatic illustration).

The catalytic wire may be composed of platinum or other suitable substance which can be stretched out lengthwise or arranged in any other suitable position, for example, as a coil in a correspondingly shaped and arranged cartridge.

The catalytic wire 1 forms one branch A of the Wheatstone Bridge system, whilst the other branches B, C, and D consist of variable resistances which are preferably divided up into small units in order to enable better regulation of the balance of the bridge, and to produce good

ventilation to enable a temperature balance to be obtained rapidly. E indicates the galvanometer of the bridge system, F is the heating battery, and G the heating resistance. In parallel with the catalytic wire 1 in branch A of the bridge, is arranged a substitute resistance H. A switch J enables either the catalytic wire or this substitute resistance H to be switched on the bridge circuit. In series with the catalytic wire is a heat regulator K which allows the catalytic wire to be switched in or out in a gradual manner in order to spare it and prolong its life as much as possible.

A second reaction chamber M' similar to the reaction chamber M can be arranged in parallel with the heating battery F.

According to Fig. 2, a collecting device 2 which can be constructed as described in German Patent Specification No. 567,689, is inserted in a bore-hole 2. From the bore-hole 2 through a cock 4 and a pipe 3, soil gas is supplied to the reaction chamber through the three-way cock 6. From the reaction chamber the soil gas passes through a cock 7, pipe 8 and three-way cock 9 into the receiver 10 which is connected by a flexible pipe 11 and a cock 12 to a vessel 13, partly filled with mercury 14, and capable of being closed at the top by a cover 15. When the second reaction chamber M' is used, this is connected by pipe 16 to cock 4 and through a second pipe 17 to an otherwise free connection 18 to the receiver 10.

With the device described the following measurements are made, and as previously mentioned preferably in a current of gas.

The bridge is first connected to the catalytic wire in the reaction chamber and the galvanometer adjusted to a zero position by altering the resistances in the branches B, C, and D of the bridge. The vessel 13 filled with mercury is then raised and after opening the cock 12 the air is forced out of the receiver 10. For this purpose the three way cock 9 is so adjusted that the air can escape outwardly through the connection 18. After closing the three-way cock 9 the mercury vessel 13 is lowered and after the remaining cocks are opened or adjusted correctly, soil gas is aspirated through the reaction chamber M into the receiver 10 under the action of the sinking mercury. It is preferable to arrange the mercury vessel 13 in such a form that the surface of the mercury is as large as possible. By this means a high initial or final velocity of the gas current is avoided.

It is also preferable, apart from the absolute uniformity of motion during the lift of the vessel 13, to arrange fully automatic valve devices at the cocks, junctions, and the like, to ensure absolute uniformity of the current of gas. In order to drive the soil gas out from the receiver 10, after setting the cock 6, the mercury vessel 13 is raised and the gas is forced through the reaction chamber M in the reverse direction and escapes into the open air.

The soil gas is measured by catalytic combustion by means of the catalytic wire twice. The difference between the measured values obtained by these two measurements forms a direct absolute measurement of the hydrocarbon content of the soil gas.

The one measurement consists in that the soil gas is aspirated through the reaction chamber and into the receiver 10 without the catalytic wire being heated. In this case the substitute resistance H is switched in. The soil gas thus remains unaltered, that is, any hydrocarbons contained therein are not burned. During the forcing of the soil gas out through the reaction chamber 9, the catalytic wire is switched in so that any hydrocarbons present can be burned, and the alteration set up in the temperature and resistance causes the galvanometer to vary from the zero position. The measurement is carried out several times until a uniform value is obtained, and an average value can be calculated for normal soil gas.

In the second measurement the catalytic wire is switched in during the first passage of the soil gas through the reaction chamber. Any hydrocarbons which may be present in the soil gas are thus burned during the passage into the receiver, and the receiver therefore, receives and contains purified gas. When this is passed back through the reaction chamber into the open air, the catalytic wire is switched in, the throw of the galvanometer is again measured, but it will be different from the throw during the first measurement depending on the presence of hydrocarbons or other combustible substances in the soil gas. This difference as stated is a direct measure of a function of the hydrocarbon content.

In the second measurement the gas is burned during the aspiration through the reaction chamber into the receiver 10, and can thus be described as 'pre-burned', whilst in the first measurement it may be designated 'unburned' gas. If hydrocarbons or other combustible substances are present in the soil gas, the measurement for the unburned gas is more or less different from that of the preburned gas whilst they may well have the same value when no hydrocarbons or other combustible substances are present.

The velocity of the gas during the passage through the reaction chamber must have a definite value. It must not be too great or too small. Above all turbulence must be avoided in the reaction chamber. For this purpose the inlet and outlet openings of the cocks 6 and 7 to the chamber must have definite proportions.

The catalytic wire and its cartridge like casing are arranged to be rotatable, so that the gas can be arranged to flow over it in the best position for the measurement, and the galvanometer throw can be adjusted. For this purpose a cover S or S' is rotatably arranged with a scale and indicator and can be fixed in a definite position by calibrating the wire.

The catalytic wire can also be arranged in the reaction chamber as shown in the drawing, i. e. suspended. It can also be stretched by suitable devices, e. g. a spring, or by its own weight or by stretching in the incandescent state.

The method can also be carried out by collecting from the bore-hole at one time and in one large container, all the gas required to make the individual measurements, which have to be made at the bore-hole. This may be accomplished by air displacement or by first emptying the container of air. The container can then be taken to any desired place, e. g. the laboratory, where only the quantity of air required for each individual measurement can be taken out. In this manner the measurements can be made independently of the weather conditions prevailing at the bore-hole.

In practice it has been shown that the production and handling of usable catalytic wires, in particular when as proposed in German Patent Specification No. 573,759, a compensating treatment is carried out, is extremely difficult. Therefore it is a great advantage of the invention that only

one catalytic wire is used in the bridge, as a calibration of a number of wires is almost impossible, as their properties often alter during measurements.

With the use of this one wire the bridge can be calibrated to it without difficulty. Further, this wire which can be inserted in a cartridge can be replaced easily and quickly.

In order to avoid the residue of both kinds of gases passed through the reaction chamber remaining in dangerous spaces in the tube 8 and cock 9, so that it can only be removed by repeated rinsing, the following method is adopted.

A second chamber M' which can only be used as a combustion chamber, is employed. This is similar to the reaction chamber 1, and also contains a catalytic wire, which can be switched in and out at will.

The soil gas is first fed from the tap 4, through the tube 16 into the combustion chamber M' and from here, after preburning or non-burning of the air current, is passed through the tube 17 into the receiver 10. Tube 5 is not used in this method. From the container 10 the air is passed through the actual reaction chamber M and there measured. This form of the process has the advantage that the catalytic wire 1 in the reaction chamber M is actually used for measurement only, and the gas is passed over it in one direction only, so that no alterations occur in the wire. As the wire arranged in the second chamber M' which only serves as a combustion chamber, is only used for burning any hydrocarbons or other combustible material present in the soil gas, it is not necessary that it should have exactly the same properties as the wire 1 in the reaction chamber M.

It is thus possible to make the auxiliary resistance H as a catalytic acting wire and to effect the combustion of the hydrocarbons or the like so that in this case the actual catalytic wire 1 is preserved.

Should it be required, under certain circumstances, to measure a quiescent mixture, then the auxiliary resistance H can be reduced down to the equivalent of the wire resistance used. The method of measurement is then as follows: once preburned and once unburned soil gas are fed through the chamber M' into the chamber M and there enclosed, and after closing the switch J which is specially provided therefor, and the galvanometer throw is determined in both cases.

REINHOLD WEBER.

PUBLISHED

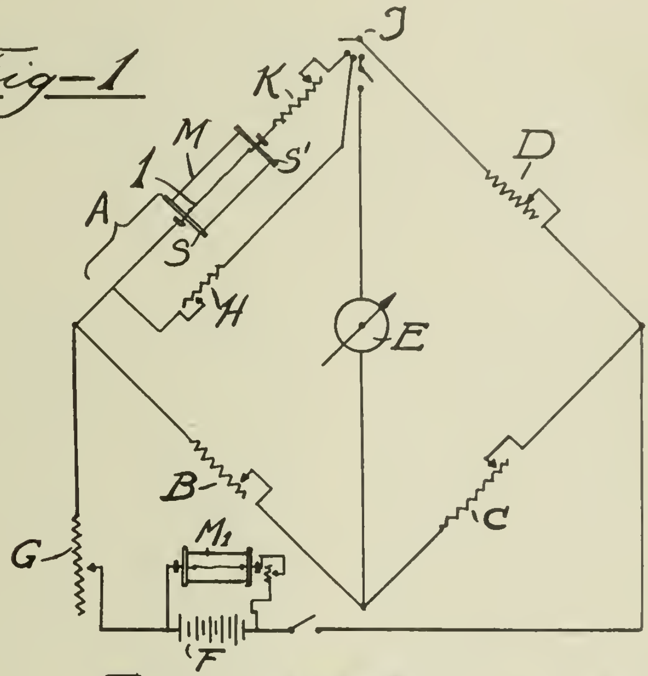
APRIL 27, 1943.

BY A. P. C.

R. WEBER
METHOD AND APPARATUS FOR DETERMINING
COMBUSTIBLE GASES IN GAS MIXTURES
Filed Jan. 4, 1939

Serial No.
249,348

Fig-1



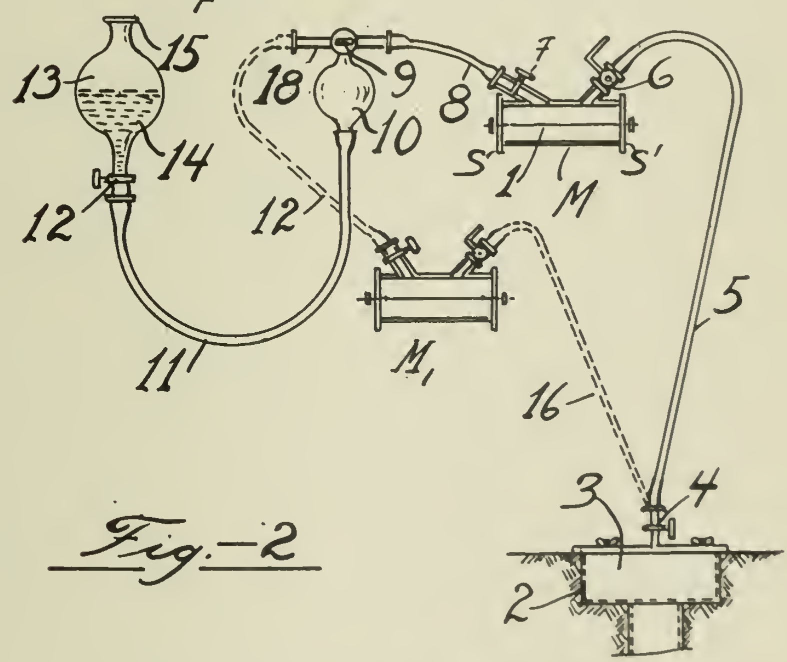


Fig.-2

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By P. L. Young Attorney

Published Apr. 27, 1943

Serial No. 250,446

ALIEN PROPERTY CUSTODIAN

CENTRIFUGES FOR GRANULAR MATERIAL FOR CLEANING AND SCALING PLANTS

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Application filed January 11, 1939

The invention relates to a rapidly rotating blade wheel or distributor without a peripheral slide plate, controlling the direction of throw, to be used for centrifuging granular material, such as steel sand, quartz sand or the like, for cleaning and scaling plants. The novelty in this blade wheel consists in the formation or arrangement of the inner part of the centrifugal blades, that is the part adjacent to the wheel centre, with the object of either retarding or accelerating the flow of the sand from the centrifugal blades, depending on the desired direction of throw, the arrangement and formation of the outer part of the centrifugal blades and the nature of the sand. With this formation or arrangement of the inner part of the centrifugal blades the effect is achieved that the sand can be supplied in a simple manner to the centrifugal blades, i. e. without complicated mechanism subject to great wear, in a convenient direction, namely at least substantially radially, and is lightly received by the centrifuging blades—therefore causing little wear both on the blades themselves and on the cleaning sand—and flung off only in one direction (i. e. the particular direction desired at the moment) even when the mouthpiece of the sand supplying device is located in the centre of the plane of rotation.

Known blade wheels which hurl the granular material only in one, viz. in the temporarily desired, direction achieve this end either by means of a segment-like or circular slide plate surrounding the blade track and having an ejection aperture the position of which determines the direction of throw, or by means of a corresponding eccentric position of the mouthpiece of the device supplying the sand, thus dispensing with the provision of a peripheral slide plate. The first type of such blade wheels, in which the mouthpiece of the device supplying the sand can be located either in the centre of, or eccentric to, the plane of rotation and in which the sand is supplied to the rotating centrifuging blades either radially or transversely to their plane of rotation, has above all the great disadvantage that the slide plate is exposed to extremely hard wear, so that these centrifugal devices are completely useless in practice. In the case of the second type of these blade wheels, in which the mouthpiece of the device for supplying the sand is disposed eccentrically to the centrifuging blades and therefore the provision of a peripheral slide plate is superfluous, said mouthpiece is located either close to or at some distance from the axis and the sand is supplied to the rotating centrifuging blades either radially or transversely to their plane of rotation. Blade wheels in which the eccentrically disposed mouthpiece of the sand supplying device is located at a considerable distance from the axis possess above all the defect of great wear on the centrifuging blades and rapid destruction of the sand, which is caused by the high tangential velocity present at that point. In addition, their cleaning performance is only small, so that such forms of construction have also been useless in practice. Known blade wheels of the type in which the eccentrically disposed mouthpiece of the apparatus which supplies the sand to the centrifuging blades either radially or transversely to their plane of rotation lies close to the axis are, finally, relatively complicated. In addition, the reception of the sand, fed only by the force of gravity, by the centrifuging blades sometimes leaves much to be desired in these devices.

All of these defects are obviated by the centrifugal wheel of the present invention, different forms of construction of which are illustrated by way of example in the accompanying drawings in which—

Figure 1 is a front view, and

Figure 2 is a side view of one form of the centrifuging wheel.

Figures 3 and 6 show the sand supply pipe.

Figure 7 is a front view of another form of the centrifuging wheel.

Figure 8 is a front view of a further construction of the centrifuging wheel.

Figure 9 is a front view and

Figure 10 is a side view of still a further construction of the centrifuging wheel in which the blades are mounted between two rotating discs.

Figure 11 is a cross-section and

Figure 12 is a plan view of a construction, in which blade-holders are secured directly on the shaft.

Figure 13 is a front view and

Figure 14 is a side view of adjustable blade-holders.

Figure 15 is a front view of a blade consisting of two parts.

Figure 16 is a cross section through a channel-shaped blade.

The centrifugal wheel consists essentially of the rotating disc **2**, mounted on the driving shaft **1**, with the holders **3** or **3***a* mounted thereon carrying the centrifugal blades **4**, **4***a*, **4***b*, **4***c* or **4***d* and the sand supply pipe **5**. The number of the blades depends on individual circumstances. As a rule it should be small.

In the example shown in Figures 1 and 2, the inner part of the centrifugal blades 4 and 4a is bent away in the opposite direction to the direction of rotation, i.e. rearwardly, while the outer part of the centrifugal blades 4 and 4a is, for example, radially directed. The position shown in Figure 1 of the inner part of the centrifugal blades 4 and 4a retards the flow of the sand from the centrifugal blades 4 and 4a. This illustrated formation and arrangement of the inner part of the centrifugal blades 4 and 4a and the degree of their curvature towards the rear should be approximately correct when, as is generally the case in practice, it is desired to hurl the cleaning sand downwardly, assuming the latter to be of the normal type and the outer part of the centrifugal blades to be arranged in the radial direction. If the inner part of the centrifugal blades 4 and 4a were not bent towards the rear, but if its shape were like that of the outer part, then, depending on the shape of the centrifugal blades, the sand would be hurled off either radially in all directions or possibly upwardly. If, when the outer part of the centrifugal blades is arranged radially and normal cleaning sand is employed, it is desired to throw the sand off to the left with the blade wheel illustrated in Figures 1 and 2, the inner part of the centrifugal blades 4 and 4a is bent to a smaller extent than when the blade wheel is to throw downwardly. If the cleaning sand is, finally, to be thrown upwardly, the degree of curvature may be even smaller, or it may not be present at all, or it may be made in the opposite direction.

All this is substantially dependent on the shape of the outer part of the centrifugal blades 4 and 4a and the nature of the cleaning sand which is used. How the inner part of the centrifugal blades 4 and 4a is directed and to what extent it is bent in one direction or the other determines the rate of flow of the sand from the centrifugal blades 4 and 4a. Thus, if the inner part of the centrifugal blades 4 and 4a is bent in the opposite direction to that of the rotation, that is to say to the rear (Figures 1 and 2), the flow of sand from the centrifugal blades 4 and 4a is retarded. If, on the other hand, the inner part of the blades is bent in the direction of rotation, i.e. forwardly (Figure 3), the flow of sand from the centrifugal blades 4 and 4a is accelerated. The rate of flow is to be so adjusted that the sand is thrown off by the centrifugal blades 4 and 4a in the desired direction. The exact length and the exact shape of the inner part of the centrifugal blades 4 and 4a which is to be bent away to a varying extent and in varying directions can readily be determined in practice, by means of tests. The wear on this inner part of the centrifugal blades 4 and 4a is only slight, even in the case of the substantial bending thereof illustrated, since at that point the tangential velocity and thus the pressure of the sand on its path are still relatively small. The number and the cross-sectional shapes of the centrifugal blades may also differ from those shown in the drawings. In certain circumstances the blades may even be of tubular cross-section, for instance as shown in figure 7. A second rotating disc, having an aperture 9, may furthermore also be mounted opposite the rotating disc 2, as shown in figure 10, so that the centrifugal blades would thus be mounted between two rotating discs 2 and 2a. Finally, the rotating discs may also be entirely dispensed with in certain circumstances. The holders 3 and 3a are in such a case secured directly on the shaft 1 as shown in figures 11 and 12.

The holders 3 and 3a are mounted on the rotating disc 2 or on the shaft 1 either immovably or adjustably. The holders can be adjustable on an arc of a circle and/or in the radial direction and/or may also be adapted to rotate independently of the disc or shaft. The latter form of adjustability is convenient in order to be able to make small adjustments of the direction of throw when a particular shape of centrifugal blade is provided for a determined direction of throw. According to figures 13 and 14 the holders 3 and 3a are secured by bolts and nuts in radial slots of a disc 7 which after having loosened the screw 8 can be rotated in both directions until the desired position is found.

The disc 7 is mounted in a recess of the disc 2. In this construction the holders 3 and 3a are (by the rotation of the disc 7) adjustable on an arc of a circle and (by means of the slots) adjustable in radial direction. Eventually they are adapted to rotate round their fastening-bolts.

The centrifugal blades 4 and 4a secured to the holders 3 and 3a may also be in two parts, in such a manner that the inner bent part and the outer part each form separate parts (see figure 15). In this case the inner bent part of the centrifugal blades can be independently adjusted about the axes of the holders 3 and 3a, while the outer part of the centrifugal blades may be fixed in a desired direction or may likewise be adapted to be independently adjusted.

Adjustment of the direction of throw, when using centrifugal blades shaped for a determined direction, can also be obtained by providing the sand supply pipe 5 illustrated in Figures 1 and 2, which allows the sand to fall vertically downwards, with a deflector 6 which may be rotatable or fixed in the desired direction, such as that shown by way of example in Figures 3 to 6. Figure 3 shows the deflector 6 viewed from the front and Figure 4 shows it viewed from the side, the sand falling vertically downwards. In Figure 5 the deflector is turned to the left and in Figure 6 to the right, whereby the flow of the sand is correspondingly deflected from the vertical, thus slightly modifying the direction of throw.

In Figures 1 and 2 the mouthpiece of the sand supply pipe 5 lies in the centre of the plane of rotation, but it may naturally also lie eccentrically adjacent the axis as shown in Figures 9 and 10. In this case, although the above described advantages, which are obtained in the case of the mouthpiece of the sand supply pipe 5 being mounted in the centre of the plane of rotation, are not obtainable to the same extent, yet on the other hand, there is the compensation that exact direction of flow can be maintained even in the event of less accurate formation of the centrifugal blades in respect to the otherwise necessary shape of the inner and outer parts thereof and also in the event of a difference in the nature of the cleaning sand.

The striking side of the blades 4 and 4a may be channel shaped (Figure 16) and may be formed with a transverse rib at the inner end. A blade which is not channel-shaped but furnished with a flat striking surface may also be provided at the inner end with a transverse rib or the like, to prevent the cleaning medium from sliding away from the inner end of the blade.

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PUBLISHED

APRIL 27, 1943.

BY A. P. C.

K. GROCHOLL

CENTRIFUGES FOR GRANULAR MATERIAL FOR CLEANING AND SCALING PLANTS

Filed Jan. 11, 1939

Serial No. 250,446

2 Sheets-Sheet 1

Fig. 1.

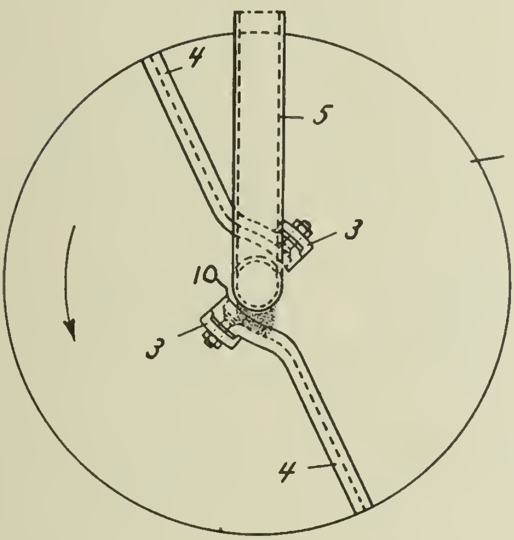


Fig. 7.

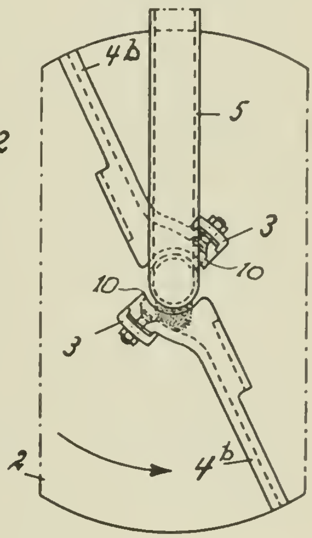


Fig. 2.

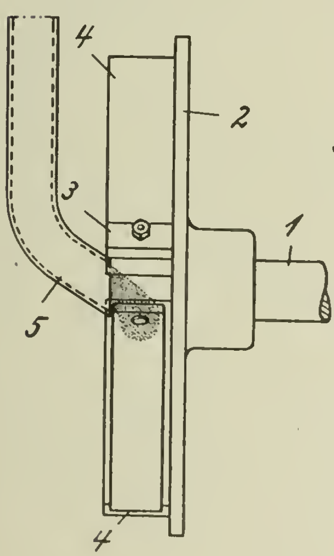


Fig. 3.

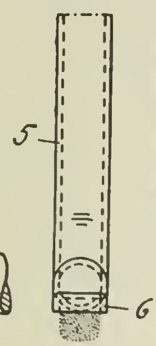


Fig. 4.

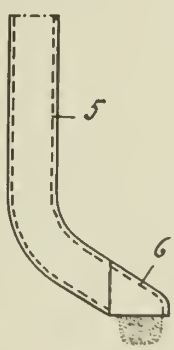


Fig. 5.

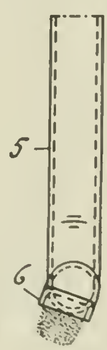
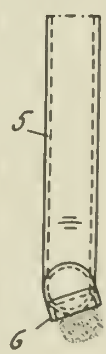


Fig. 6.



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CENTRIFUGES FOR GRANULAR MATERIAL FOR
CLEANING AND SCALING PLANTS
Filed Jan. 11, 1939

Serial No.
250,446

2 Sheets-Sheet 2

Fig. 8.

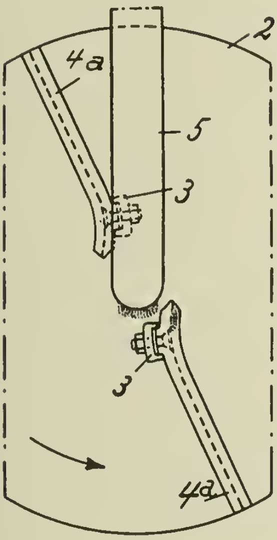


Fig. 9.

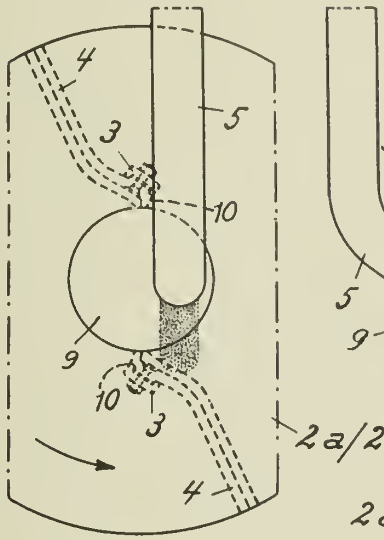


Fig. 10.

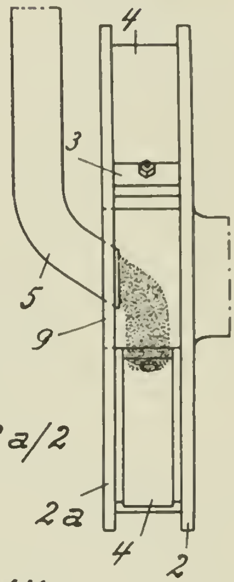


Fig. 11.

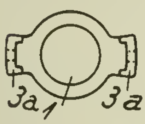


Fig. 12.

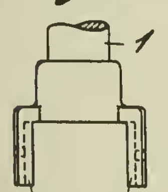


Fig. 16.

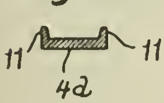


Fig. 13.

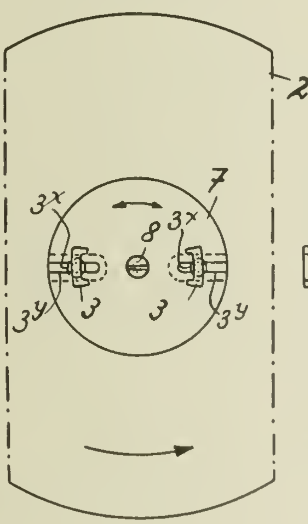


Fig. 14.

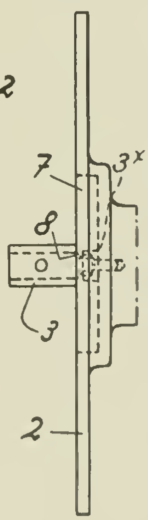
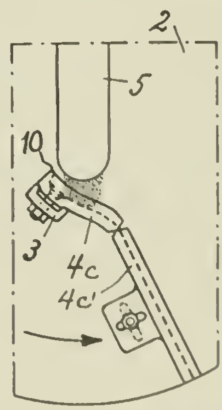


Fig. 15.



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Published Apr. 27, 1943

Serial No. 251,858

ALIEN PROPERTY CUSTODIAN

METHOD AND APPARATUS FOR OBTAINING MIXTURES OF SMALL QUANTITIES OF SUBSTANCES IN SOLUTION OR IN SUSPENSION IN A FLOWING LIQUID

Giovanni Friedmann, Milan, Italy; vested in the Alien Property Custodian

Application filed January 19, 1939

It is known that, at present, even when there exists water under a certain head at the same level of the farm-manure pits, it is possible to use the water for fertilizing irrigation only when its pressure is reduced to naught, by running the water into the mixing pits or vats for diluting urines and dung. This liquid excrements (manure draining) is used for fertilizing irrigation of the land which lies at a lower level, and only exceptionally it is carried up-hill by means of tank wagons, or pumped up by means of special pumps and piping to the land overhead. This because it is very difficult and expensive to carry dung up-hill and particularly liquid.

Soil fertility therefore concentrates on the land placed under the level of the cattle stalls and sheep folds at the farmyards. Besides, urines and strained dung are never sufficiently diluted for reaching their greatest fertilizing efficiency, which is the greater, the more frequent the distribution to the crops of liquid in a very diluted form. There follows that, whilst the land below the stables is too rich and consequently covered with ammoniacal vegetation, of little value as fodder, the land overhead is semi-improductive being not or insufficiently fertilized.

To remedy this deplorable state of matters which causes so great a prejudice to agricultural economy, the system and apparatus according to the present invention, without requiring complicated and expensive machinery, difficult to handle by country folk, allows, with a small outlay in equipment and scarcely any operating expenses, the fertilization of land which is at present hardly productive; this is possible when one may dispose of even small amounts of water at a higher level.

One of the ways of applying of the invention is illustrated, solely as example, in Fig. 1 of the attached drawing, showing in longitudinal section, an apparatus capable of achieving the purpose of the invention. A special nozzle **3** with its diffuser **4** proportioned to the volume and speed of the liquid is fixed on the main pipe **1**, coming from intake reservoir or from a pump, in proximity to the urine and pulpy dung in suspension in the liquid. Liquid excrements to be mixed, arrives through a secondary pipe **5**, also of ample diameter, in chamber **6**. Nozzle **3** and diffusor **4** can be easily changed, in accordance with the particular conditions of the plant.

The practical arrangement of a mountain plant is as follows: Unless a canal of running water is obtainable at a certain level, in which case it is sufficient to build an intake reservoir and cabin, it is necessary to have a tank or reservoir providing a certain head of water into which to collect the flow of springs or drains etc. It should be reckoned that for each 100 meters of water-head pressure, the diluted liquid may rise at most to 80 meters. Preferably the apparatus should not draw-up the liquid by suction and therefore it is advisable to place the mixer under the vats. A great dilution is advantageous both from the agricultural point of view as from that of obtaining the best results from the use of the apparatus.

If there is no natural water-head or if the latter is insufficient, in order to fertilize the whole land, one could make use of a pump, pumping up the water even to the higher spots where the natural pressure cannot reach. In such cases, any pump for drinking water or for irrigation may do.

Fig. 2 shows in plan a mixer in which, by means of a three-way valve **7**, the same pressure of the water may be used for cleansing nozzle **3** by means of a washing circuit **8**. A pump can also be switched-in between **9** and **10** for increasing the water pressure, when the natural pressure should prove insufficient for reaching the above stated high spots of land.

Figs. 3 and 4 show, respectively in plan view and in vertical section, a plant for a mountain village, which utilizes a stream **11** for providing the fertilization of the land slopes on both sides N and S of the valley.

From the damming reservoir **2**, departs the pressure piping **16** which surrounds the village **12** and in which are inserted some mixers **13**. From village **12** a piping **14** departs which conveys the fertilizing water. In this piping the hydrants **15** are inserted to which the displaceable pipes are attached which permits the entire zone to be uniformly irrigated and dunged.

The apparatus offers also the possibility of achieving a timely disinfection or wash-outs of poison gas or liquid (as for instance a wash-out of calcium chloride against yperite). The disinfecting substances may be used at their maximum of concentration, as the apparatus provides for diluting them; thus greatly reducing the expenses of transport and of spraying.

The apparatus can be used in the same manner for mixing fire extinguishing substances with the water employed in fire extinction.

Another application is that concerning anticriptogamic or antiparasite liquid spraying, by making use of the water under pressure of the common water main supplies.

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PUBLISHED

APRIL 27, 1943.

BY A. P. C.

G. FRIEDMANN

METHOD OF FERTILIZING LAND

Filed Jan. 19, 1939

Serial No.

251,858

3 Sheets-Sheet 1

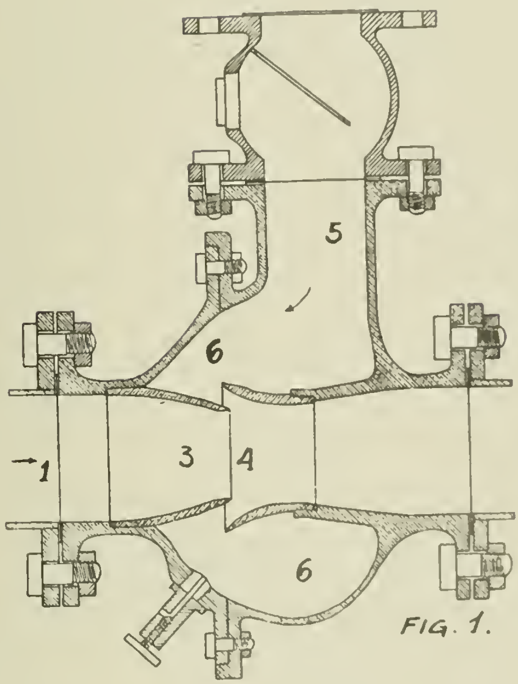

FIG. 1.

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PUBLISHED
APRIL 27, 1943
BY A. P. C.

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METHOD OF FERTILIZING LAND
Filed Jan. 19, 1939

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251,858
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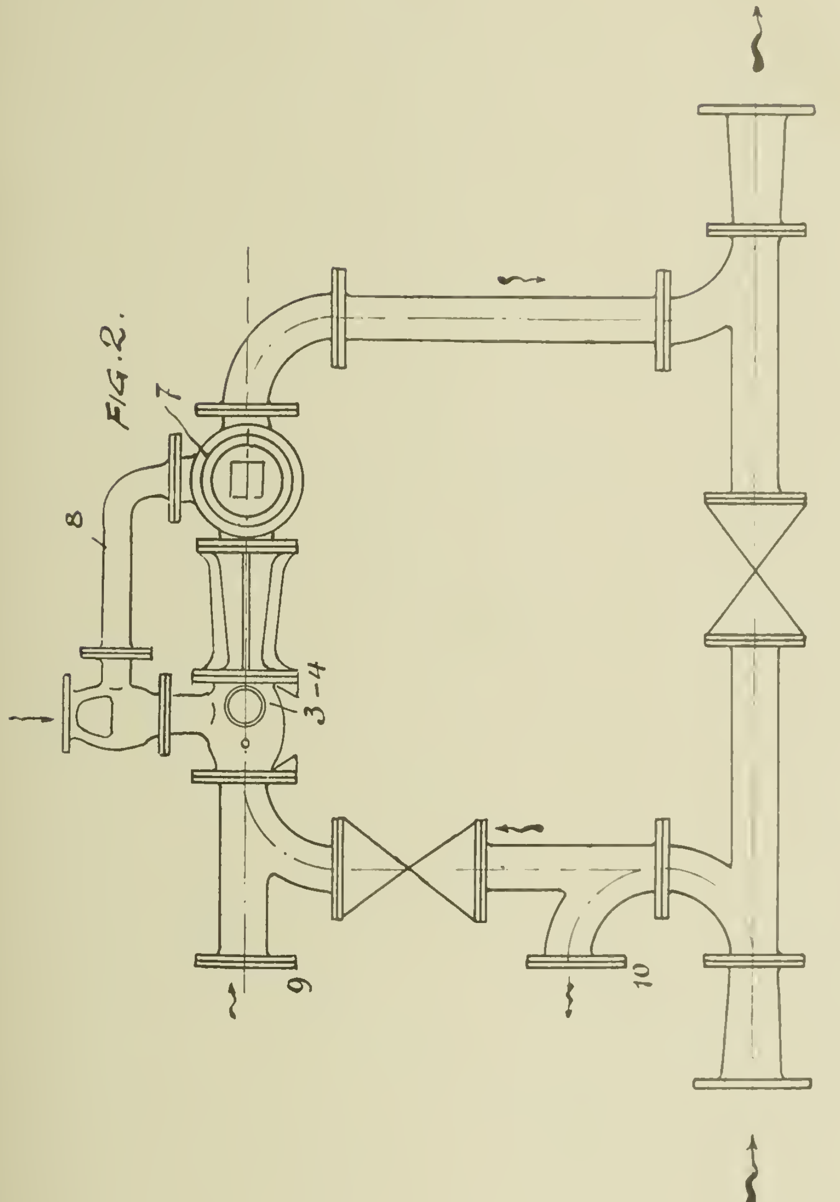
FIG. 2.



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APRIL 27, 1943.
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METHOD OF FERTILIZING LAND

Filed Jan. 19, 1939

Serial No.
251,858

3 Sheets-Sheet 3

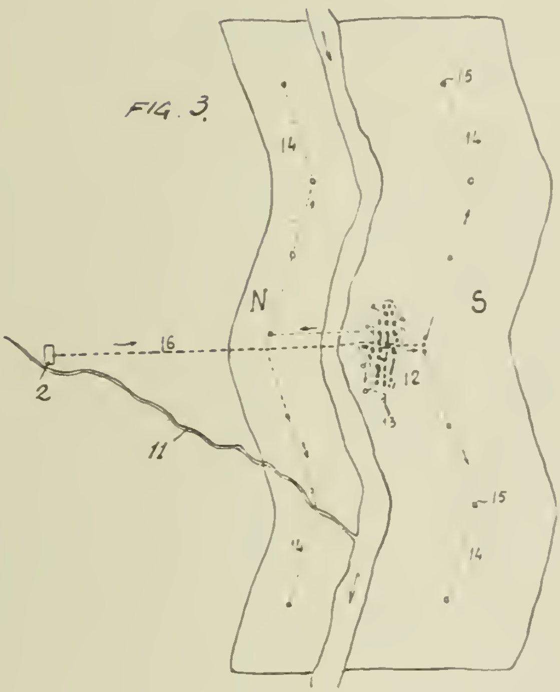

FIG. 3.

FIG. 4.

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Published Apr. 27, 1943

Serial No. 253,230

ALIEN PROPERTY CUSTODIAN

PROCESS OF MANUFACTURING FILAMENTS, FILMS AND THE LIKE FROM KERATINOUS MATERIALS

Jacob van den Bergh, Nijmegen, Gerardus Jacobus Milo, Tilburg, and Henri Evert Piet van Dijk, Oss, the Netherlands; vested in the Alien Property Custodian

No Drawing. Application filed January 27, 1939

It has been proposed to dissolve materials containing keratin, such as horns, hooves, feathers, hair and wool and waste products thereof in alkali hydrates, or metal amines and to spin the solutions thus obtained into filaments. No favorable results, however, have been obtained therewith so that the method has not been adopted in practice.

Keratin-containing materials, particularly wool, have also been dissolved in alkali sulphides, but up to the present such solutions have not been spun into filaments.

According to the invention suitable filaments, films or the like can be obtained by adding to the spinning solution and/or to the spinning bath substances which during the manufacturing process will form condensation products either individually or in combination with each other, or in combination with the keratinous substance.

When trying to coagulate solutions of keratin—e. g. in alkalihydrate or sulphide—in one of the baths which are generally used for spinning cellulose solutions, it will be found that either one obtains no filaments at all, or that there are formed filaments which are practically useless. If, however, one or more of the substances mentioned above are added, this will act favorably upon the formation of the filament, while the mechanical properties of the filament thus formed and the finished product made thereof are considerably improved.

The keratin solutions used according to the invention are preferably prepared by dissolving the keratinous starting material, such as e. g. waste wool or hooves in a solution of alkali sulphide. It is supposed that the keratin molecule when dissolved in alkali sulphides is disintegrated to a smaller degree than when dissolved in alkali hydrates. According to modern conceptions the chains which are supposed to be present in the albumen molecule are connected with each other by means of the sulphur atoms. It is plausible that this so-called "sulphur-bridge" will be ruptured to a lesser degree by a treatment with alkali sulphides than by a treatment with alkali hydrates and that it is of advantage to keep the molecules of the albuminous residues from which the condensation products are produced in the process according to the invention, as large as possible.

The solution may be prepared by heating the material with a sodium or a potassium sulphide solution, and subsequently separating the solution from the undissolved residue by filtering. It is also possible to use other keratin solutions, e. g. solutions in alkali hydrates or ammonical copper oxide, but these solutions generally will produce less favorable results. The keratin, for instance, will be disintegrated too far if dissolved in a highly alkaline liquid such as an alkali hydrate solution.

The substances to be added may be of different character and they may be added either to the spinning solution, to the spinning bath or to both.

In the first place substances may be used which will form condensation products with keratin, such as e. g. aldehydes or rhodanides. They may be added to the spinning solution, preferably at such a time that an initial condensation will have taken place already prior to the spinning treatment. This maturing process, however, may not proceed so far as to render the keratin insoluble. It is, however, also possible to add the said substances to the spinning bath, in which case condensation occurs in the spun filament.

According to the invention preferably two or more substances are used which together will produce a condensation product. Most suitable for this purpose are those substances which under manufacturing conditions, i. e. in an aqueous medium or during the drying of the filament at a moderate temperature, will yield synthetic resinous products, e. g. urea and formaldehyde or other aldehydes, phenols and aldehydes or the like.

The process preferably is carried out in such a way that both the aldehyde and the other synthetic resin component are added to the spinning solution and that the spinning solution is subjected to a maturing process, for the purpose of obtaining the degree of condensation of the synthetic resin components, desirable for spinning. Other embodiments of the invention are also possible; one may, for example, add one of the components (preferably the aldehyde) to the spinning bath and the other component to the spinning solution or else dissolve both components in the spinning bath, in which case this latter may of course, only be used within a given time after the preparation thereof.

When using the abovementioned combinations of substances one of the components of which is an aldehyde, it will of course be possible to obtain both synthetic resin-like products and condensation products of the aldehydes with keratin.

The best results have been obtained by adding urea and formaldehyde to the spinning solution. The maturing time depends on various factors, such as the composition of the spinning solution and the temperature, and may vary between a

few hours and several days. Good results have been obtained e.g. with a spinning solution containing 0.15–0.25% of urea and at room temperature the maturing time may be 16 to 18 hours. If maturing is continued for a longer time the filament may become too brittle; if the maturing period is too short, the filament will be plastic, but too weak. At higher temperatures the maturing process will proceed more quickly, and this will also be the case, if acetaldehyde is used instead of formaldehyde.

It has been found that the known spinning baths used in the viscose industry which together with sulphuric acid contain one or more salts, particularly sodium sulphate, magnesium sulphate, ammonium sulphate, zinc sulphate and the like, are also extremely suitable for the coagulation of the keratin solutions according to the invention. The filaments are washed immediately or some time after spinning, contingently after having been passed through a second bath in order to remove the water soluble constituents and subsequently dried.

In the processes described above there is added a substance which will form a condensation product either with a substance added or with the keratin itself. However, substances having the property of producing polymerization products, e.g. compounds belonging to the class of the vinyl resins, may also be used. These substances also will generally be added to the spinning solution and not to the spinning bath and like in the preceding case a maturing period will be desirable.

The filaments obtained may be hardened, if desired, by treatment in a suitable bath, e.g. of a formaldehyde or an alum solution.

The invention will be illustrated by the following example.

250 grams of finely ground hooves are mixed with a solution of 250 grams of sodium sulphide in 1150 grams of water, and the mixture is heated while stirring to a temperature near the boiling point. The ground hooves will dissolve for the greater part, the solution is separated from the undissolved residue by filtration.

In the keratin solution thus obtained 15 grams of urea are now dissolved and 150 grams of formaline (40%) are added. This solution is allowed to mature during 18 hours at room temperature, and is extruded at room temperature in a bath containing 30% of H_2SO_4, 10% of Na_2SO_4 and 3% of $(NH_4)_2SO_4$. The filament obtained is washed with water and dried at a moderate temperature.

Instead of ground hooves one may also use other keratin containing substances. A very suitable first material is e.g. waste wool obtained by shearing which consists of very short fibres, and is therefore unsuitable for textile materials.

The invention renders it possible to produce synthetic wool or wool silk in the form of filaments so fine as to be particularly suitable in the hosiery industry, especially for the making of fine hose for which natural wool has proved to be rather unsatisfactory. Apart from the fine yarns to be worked into fabrics or into knitted goods other products such as e.g. artificial horse hair and films can also be produced from the keratin solution according to the invention. The material is also suitable for electrical insulations.

If desired the keratin solution may be mixed with other artificial silk spinning solutions, e. g. with alkaline casein solutions or with viscose or ammoniacal copper oxide-cellulose solutions. In that case filaments or films are produced which consist of mixtures of keratin with another albuminous substance or with cellulose.

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HENRI EVERT PIET VAN DIJK.

ALIEN PROPERTY CUSTODIAN

FIRE ARMS

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Application filed January 30, 1939

This invention relates to breech closing means for fire arms and more particularly for automatic and semi-automatic fire arms and it comprises a breech closing mechanism in which the breech bolt cooperates with a slider mounted to move longitudinally with respect thereto, said slider cooperating with means devoted to lock said breech bolt in breech closing position.

An entirely reliable and self locking closing mechanism is obtained in accordance with this invention by means of parts to which a translatory rectilinear movement only is imparted and with the aid of flat sloping surfaces which may be easily machined with full precision as required.

An embodiment of this invention is illustrated by way of example on the annexed drawing and

Figure 1 is a longitudinal fragmentary section on the barrel axis of an arm equipped with the means of this invention the breech bolt being in closed position.

Fig. 2 is a longitudinal section similar to Fig. 1 with the breech bolt in open position;

Fig. 3 is a diagrammatic section of certain parts of the fire arm shown in Figs. 1 and 2 drawn to an enlarged scale with respect to said figures and with the breech bolt in open position;

Fig. 4 is a section similar to Fig. 3 with the breech bolt in closed position;

Fig. 5 is a transverse section on line 5—5 of Fig. 4;

Fig. 6 is a side view of a separate locking member and

Fig. 7 is a top plan view of the locking member shown in Fig. 6.

In Figures 1 and 2, 1 denotes the fire arm barrel and 2 denotes the breech which has grooves 8 in internal faces of opposite walls thereof, said grooves being connected with sloping seats 10 which expand transversely to the respective groove 8 connected therewith and are inclined to the direction in which said groove extends.

An elongated member 26 which provides a breech bolt is mounted to reciprocate in the chamber confined within the breech 2 and said bolt provides a forwardly-extending rod 27 adapted to abut by its free end on the base of a cartridge located in barrel 1; the bolt 26 has side lugs 28 in its intermediate portion which are arranged to reciprocate along the breech grooves 8 and provide rear transverse faces 29 at both sides of a central extension 30 of said bolt.

The bolt 26 is provided with a socket 31 opening at its rear end where the recoil spring 3 enters; said spring abuts on a plug 34 closing the breech 2 at its rear end.

The bolt 26 has a transverse slot 35 intermediate its extension 30 and its spring socket 31 and a slider 32 is mounted to reciprocate along said bolt 26 within the slot 35 thereof.

The slider 32 has side extensions 33 adapted to embrace the bolt central extension 30 and to abut on the transverse faces 29 of the bolt 26.

Locking shoes 9 are provided for cooperation with the bolt 26, the slider 32 and the breech 2 and each of them includes a main body (Figs. 6 and 7) having transverse faces 36, 37 at its longitudinal ends and a guiding lug 11 adapted to enter a cooperating breech groove 8; on each side the locking shoe 9 provides a nose confined by longitudinally extending faces 12, 12' and by sloping end faces 13, 13' the faces 12, 12' being intended to slide along cooperating surfaces of the breech 2, bolt extension 30 and slider 32 while the sloping faces 13, 13' have an inclination registering with that of the side surfaces of the sloping seats 10.

The respective positions of the bolt 26, slider 32 and locking shoes 9 are shown in diagrammatic Figures 3 and 4; when the bolt 26 is in its open position said locking shoes 9 are positioned in the space intermediate the transverse faces 29 of the bolt 26 and the opposite end faces of the extensions 33 of the slider 32 which are in their position at maximum permissible distance with respect to the bolt extension 30.

On the contrary at the time the locking shoes 9 are within the sloping seats 10 each of them abuts frontally against a face 29 of the bolt 26 and the opposite face of the cooperating seat 10 and it rests against the side face of the adjacent extension 33 of the slider 32 which projects over the bolt extension 30; the breech closing parts of the fire arm then are in their locked position.

The striker includes a stem 14 having an end pin 14'; said striker 14 is connected with the slider 32 and extends throughout a central bore of the bolt 26 where a spring 15 is located, this spring abutting on a flange 14'' of the striker 14 by one of its ends and on a sleeve 38 fast in the bolt 26 by its opposite end.

The spring 15 is thus operative both to drive the striker 14 forward and to move the slider 32 into its advanced position which corresponds with the bolt locked position.

The slider 32 is provided with a transverse finger 18 intended to cooperate with a sear 19

to hold the bolt 26 in open position and the striker spring 15 cocked, said sear 19 being adapted to be released by means of a wedge trigger 20 actuated by a push-knob 39.

The finger 18 is located in the path of the rear end of a rod 21 mounted to reciprocate longitudinally in the breech 2 and resiliently held in its position spaced from finger 18 by a spring 22 (Figs. 1 and 2).

The front end of the rod 21 provides a sleeve 23 slidably fitting over a spout 24 where a firing gas outlet 25 from the barrel 1 opens.

The bolt 26 has in turn on the path of the finger 18 a similar finger 18′ which is engaged by the finger 18 in its recoil stroke.

In the position of the parts shown in Fig. 1 the fire arm breech 2 is closed by the front face of the rod 27 of the bolt 26 located against the rear end of the bore of the barrel 1.

The breech bolt 26 is in turn locked by the locking shoes 9 which abut on the transverse faces 29 thereof and are in turn engaged within the seats 10 of the breech 2 said shoes 9 being restricted from coming out therefrom due to their abutment against the sides of the extensions 33 of the slider 32.

The breech is thus closed in a fully efficient manner and its closing is the more reliable the greater the rearward thrust exerted on the bolt 27, 26 because said thrust is imparted to locking shoes 9 which are thus wedged intermediate the faces of the inclined seats 10 and the slider extensions 33.

In fact the force the cartridge base transmits to the bolt 27, 26 and to shoes 9 at the time a shot is fired, is resolved into two components one of which acts on the breech 2 and the other on the slider 32 in a direction perpendicular to the barrel axis, the second named components having the same line of action and opposed directions in respect of the two shoes 9 so that no torque is imparted to the breech.

For opening the bolt 26, 27 the slider 32 is moved back; in the described construction such a back displacement is caused by the pressure imparted by the rod 21 which is moved back, immediately after a shot fired, by the action of the firing gases issuing from the barrel 1 through the duct 25 and operative on the bottom of the sleeve 23 at the time the bullet has moved past the orifice of said duct 25 in the spout 24.

At the time a shot is fired the rod 21 thus recoils under the action of the shot firing gases and imparts a blow on the finger 18; the slider 32 is thus caused to recoil against the action of the striker spring 15 whilst the bolt 26 at first remains stationary due to the longitudinal gap intermediate said slider 32 and the bolt 26.

In this operation due to the movement of the slider 32 along the bolt slot 35 the side abutments provided by the slider extensions 33 for the locking shoes 9 are removed and said shoes 9 slide along the sloping seats 10 under the action of bolt faces 29 on the shoes faces 37 due to firing gas pressure on the bolt 26, 27 and to the recoil action of the slider 32 on said bolt, said locking shoes thus finally taking a position in contact with the bolt extensions 30 (Figs. 2 and 3).

Then the bolt 26 recoils with slider 32 under the action of rod 21 and slider 32 to reach its position in which the slider finger 18 is engaged behind the sear 19 (Fig. 2).

To fire a shot a pressure is applied to the push button 39 to shift the trigger 20 and to remove the sear 19, the bolt 26 thus moving forward with the slider 32 under the action of the spring 3; at the time the bolt 26 stops in its forward end position the slider 32 further advances under the action of the striker spring 15 and the front faces of the extensions 33 thereof drive the shoes 9 in front thereto said shoes being finally caused to enter the sloping seats 10 connected with the breech grooves 8.

The slider 32 may thus reach its most advanced position to drive the striker pin 14, 14′ against the cap of a fresh cartridge fed in the barrel bore only after said shoes 9 have entirely released the path of the extensions 33 of the slider 32 and are engaged in seats 10 to lock the breech bolt 26.

Accordingly the shot is fired only at the time the bolt is fully closed and locked that is when the bolt 26 is engaged by the shoes 9 which in turn abut against the sides of the slider extensions 30.

The breech is thus fully closed at the time a short is fired and a cartridge may be struck only after the bolt has been locked in closed position, all the requirements inherent to a regular and safe operation of an automatic fire arm being thus satisfied.

The above described result is obtained without parts operating with rotary motion and accordingly no member of the mechanism is subject to harmful torsional actions.

Further due to the restricted mass of the slider 32 any liability to rebound actions is removed.

A similar action may be secured also by means different from the above described ones; by way of example a single locking shoe may be used and such shoe may be located on a side of the bolt or in the intermediate portion of the bolt.

The above described locking shoes may also be in a number larger than two and then they are conveniently arranged in a symmetrical position with respect to the bolt longitudinal axis, to remove unbalanced transverse actions.

The locking shoes may have a shape different from the illustrated one, being only essential that they are able to develop the described locking action.

Finally the rearward thrust which is required to be imparted to the slider to start the bolt opening stroke may be developed by means of hand operated means instead of by the shot firing gases.

Also the striker could be arranged in a different manner and it could be normally restricted from its forward motion by means which are released at the time a shot is fired.

The described breech closing device may also be embodied in fire arms having recoiling barrel and breech.

ALESSANDRO GÁL.

PUBLISHED
APRIL 27, 1943.
BY A. P. C.

A. GÁL

FIRE ARMS

Filed Jan. 30, 1939

Serial No.
253,661

Fig. 1

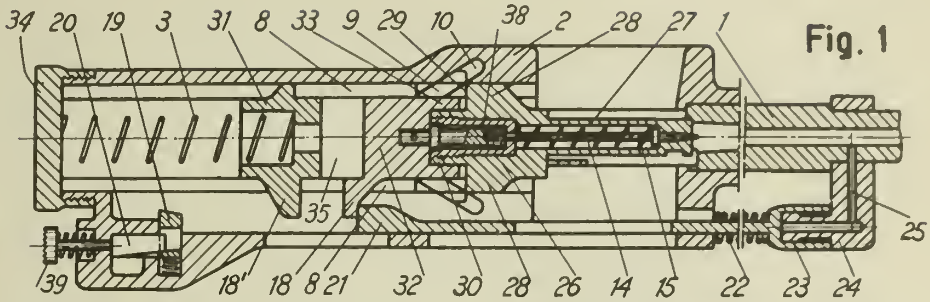


Fig. 2

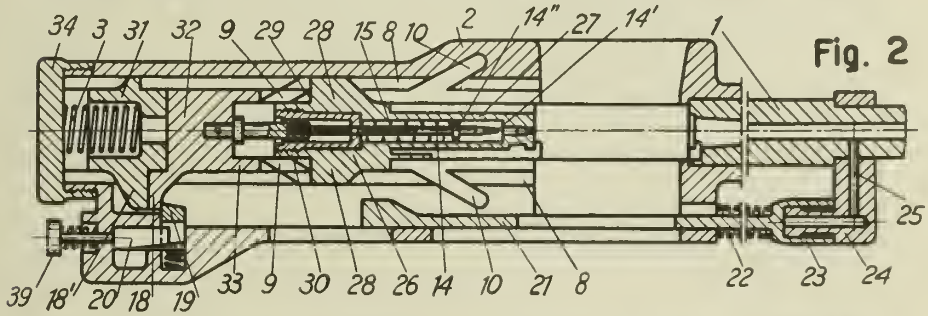


Fig. 3

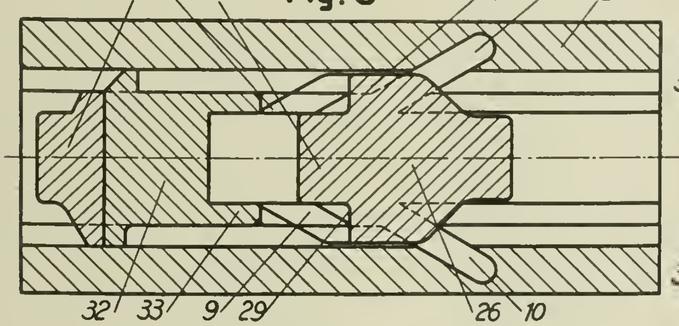


Fig. 5

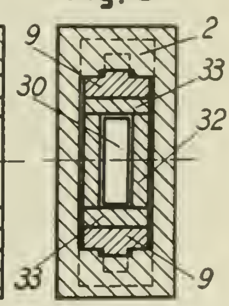


Fig. 4

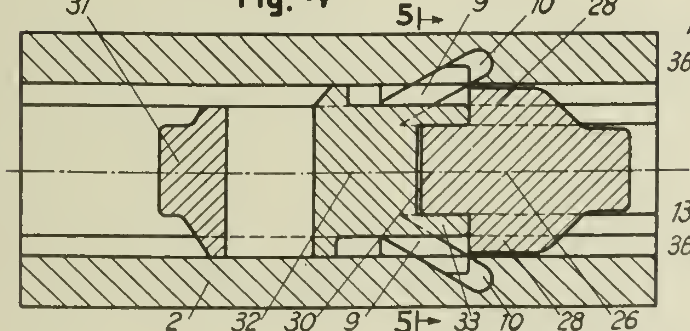


Fig. 6

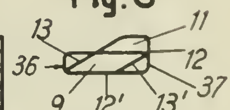
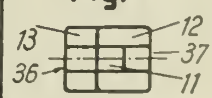


Fig. 7



INVENTOR

ALLESANDRO GÁL

BY

Young, Emery & Thompson

ATTYS.

Published Apr. 27, 1943

Serial No. 254,159

ALIEN PROPERTY CUSTODIAN

PHOTOSENSITIVE MATERIAL AND PROCESS OF MAKING SAME

Friedrich Lierg, Berlin-Zehlendorf, Germany; vested in the Alien Property Custodian

Application filed February 2, 1939

This invention relates to improvements in photosensitive material and to a process of making such photographic material, as films and papers.

It is an object of the invention to provide emulsions of silver halide dissolved in volatile organic solvents and directly united with the emulsion carrier without requiring any pretreatment of the carrier.

Another object of the invention is to provide a process in which the application of this emulsion is carried out in a single train of operations together with the production of the carrier of the emulsion.

Photosensitive emulsions of silver halides with organic volatile solvents are known. The invention has the object of utilizing the high volatility of the solvent for effecting the drying of the emulsion simultaneously with the pouring of the carrier in the usual film pouring machine. Both of these components of the web material may be dried at the ordinary rate of speed at which up to now the film base alone had been dried, and the material leaves the pouring machine ready for being reeled up on film spools.

The production of emulsions suitable for this process may be carried out by adding to, or commingling with, the esters of cellulose or any other soluble organic colloids having a charge of a certain polarity, some halide silver salts having a charge of the opposite or the same polarity. Types of these emulsions are described in a pending application of the same inventor. While they may have distinct characteristics depending upon the polarity of the ingredients, they have the quality, common to both types, that they are stable in organic solvents of great volatility without any segregation occurring. Both types, furthermore, are adapted, upon being poured out in the form of flat layers, to constitute after drying a durable photographic material ready for developing and adapted to retain its qualities for a long time. This material, therefore, has the same desirable qualities as silver bromide gelatine.

The above identified emulsions are distinguished by this greater stability and other valuable qualities from the emulsions formed from collodion in organic volatile solvents. The collodion emulsions segregate the emulsified silver bromide as a precipitate, and this precipitate must, therefore, be re-emulsified prior to its use, as for instance by long-continued shaking of the liquid. The collodion emulsions of silver bromide when poured in the form of a film generally can be employed in wet condition only; in dry condition they are detrimentally affected in the developer (formation of a veil) even though they have not been exposed.

It had been suggested heretofore to introduce some additional ingredients for the purpose of retaining sufficient moisture to permit the use of these collodion emulsion layers in "dry" condition. But these additional ingredients were not adapted to render these emulsions strong enough to withstand shipping conditions and storage, and particularly to render them durable enough for being kept in stock for considerable time.

The emulsions produced by the process of the present invention, although dissolved in organic volatile solvents are eminently suitable for photographic purposes, durable enough to be kept in stock and at the same time are adapted to be converted into dry layers by pouring. They may be poured directly upon the film base to form a firmly adherent light sensitive coating thereon, without requiring a preliminary treatment of the film base rendering the latter adhesive, as had been the practice heretofore when photographic layers were poured upon a film.

The present process utilizes as organic volatile solvents for the photosensitive layer those compounds which have no dissolving power or a very small dissolving power only for the film base.

Ordinarily, if for instance an emulsion of acetyl cellulose and silver halide is poured on a film base of acetyl cellulose, the film as well as the emulsion would be soluble in acetone. It will then suffice to modify, by means of supplementary water, the acetyl cellulose which has the lower acetyl index, as required for the solution of said cellulose so as to differentiate the dissolving power of the acetone for the two acetyl celluloses employed. The acetyl cellulose emulsion may then be applied to the acetyl film base by pouring without in any way being commingled with, or merging into, the same. The emulsion then forms a distinct layer, the pouring of which may be effected upon the dry acetyl film without softening or deforming the film. The layer of emulsion, however, after having become dry on the film base can again be peeled or stripped off of the film. But, if the liquid acetyl cellulose emulsion is mixed with a solvent of a higher boiling point which exerts a dissolving effect upon both layers of acetyl, as for instance, pyrantone, the layer of emulsion will be dried, and at the same time be cemented onto the film base so as to adhere permanently thereto.

According to the present process, the emulsions

after having been dissolved in organic volatile solvents of the type mentioned, are united with the film so as to be directly cemented onto the same without any pretreatment of the film base becoming necessary. In this manner the entire process will be greatly simplified, inasmuch as the application of the emulsion may take place by pouring simultaneously with the production of the film in the pouring machine.

For this purpose the film pouring machine is provided with a second spout to apply the acetyl cellulose emulsion to the film base. This second spout applies the emulsion to that point of the base film at which the film after having passed through the hot air shaft is thoroughly freed of all solvent. The average base film has a thickness of 15/100ths millimeter and the layer of emulsion has a thickness of about 0.01 millimeter only. It is obvious, therefore, that the film base will require a far longer period for drying than the emulsion coating. The coating is poured onto the film base after the latter has become quite dry, and hence the first pouring producing the film base is effected centrally of the film pouring machine, and the emulsion is then applied at the front of the machine, namely at that point where at present in all machines the base film itself is poured.

It has been ascertained by practical tests using acetone as solvent, that this extremely thin coat of emulsion does not require any longer travel for drying than 2–3 meter, provided the combined material travels at the ordinary rate of speed at which the base travels, before the coat is dried and the complete film suitable for removal.

Between that point where the film in its finished form is taken off the pouring machine and that point at which the complete film is being reeled up, the material is again subjected to drying as in normal film coating machines at a somewhat higher temperature (about 70 degrees C.).

In order to prevent the freshly poured and dried film base from being partly dissolved in the solvent of the acetyl cellulose silver halide emulsion, it is advisable, even in the double pouring operation to use as solvent for the emulsion a solvent which has a differential solving effect for the film base. As set forth above, a small quantity of a relatively high boiling solvent may be added for the purpose of thoroughly cementing the emulsion coat to the base.

The volatile organic solvents of the emulsion may be recovered directly while the emulsion is poured on the base, together with the solvents of the base.

In a very similar operation also the emulsion coating may be applied to paper or cardboard using a collodion coating machine equipped for recovery of the solvent. Instead of utilizing a film base to which the emulsion is applied directly without any preliminary base treatment, a thin layer of acetyl cellulose solution dyed white by means of titanium oxide or oxide of barium may be applied (instead of the usual application of baryte) and then the operations of applying the emulsion are carried out in one uninterrupted train.

FRIEDRICH LIERG.

PUBLISHED

APRIL 27, 1943.

BY A. P. C.

F. LIERG

PHOTOSENSITIVE MATERIAL AND PROCESS OF MAKING SAME

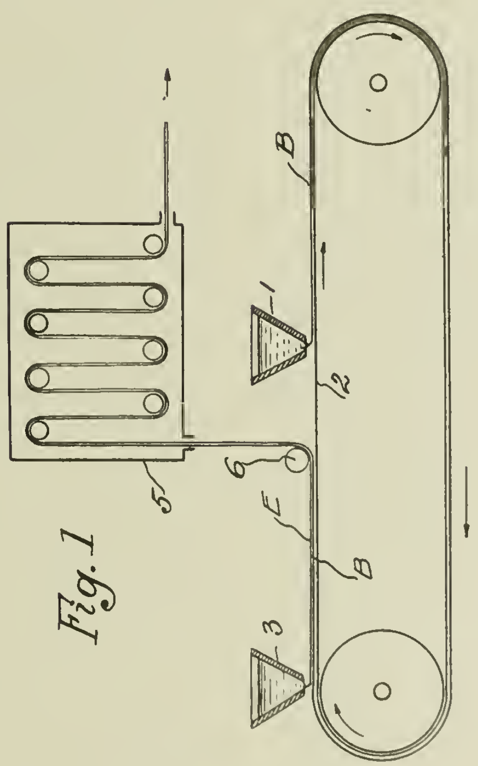
Filed Feb. 2, 1939

Serial No.

254,159

Fig. 2

Fig. 1



INVENTOR.

Friedrich Lierg

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ATTORNEY.

Published Apr. 27, 1943 Serial No. 257,029

ALIEN PROPERTY CUSTODIAN

TREATMENT OF WET SPUN PROTEIN PRODUCTS

George Stephan de Kadt, Leeuwarden, The Netherlands; vested in the Alien Property Custodian

No Drawing. Application filed February 17, 1939

My invention relates to the treatment of products such as fibres, filaments, threads, films and the like, obtained by spinning protein solutions and more particularly casein solutions in spinning baths.

When spinning artificial fibres and threads it is generally known that the threads if spun without sufficient tension show a considerable shrinkage during fixing. If, however, for instance viscose threads are spun under a sufficient tension this fixation shrinkage is reduced within reasonable limits, for instance 5%, which is explained by the fact that the cellulose micels constituting the fibres on account of their oblong form allow themselves to be directed in the direction of the thread. If, however, fibres are spun from protein solutions, it appears that the directing by applying tension during the spinning process does not take place in such a simple way, which is presumably due to the properties of the highly swollen protein particles.

Therefore it is not at all surprising that when spinning protein solutions, for instance casein solutions, threads are obtained having a considerable fixation shrinkage, though it could not be expected that this shrinkage even may amount to 50 to 60% of the spinning length.

Besides that this shrinkage results into a fibre which is a hundred percent and more coarser than the fibre initially spun, the product obtained cannot be relied upon, because unknown influences may vary this shrinkage, so that a very irregular product is formed.

I have made many efforts to remove this drawback and particularly drew my attention to the application of tensions after spinning. In this way I mostly had to be satisfied when obtaining shrinkage values of 30 to 40%. I have now found an economically realisable possibility for reducing this disadvantageous shrinkage to values below 20% and even below 10%.

The process of my invention consists herein that the product, such as fibres or threads obtained by spinning protein solutions for instance casein solutions in a spinning bath, is treated with steam or water vapour after leaving the spinning bath. If desired the steam or water vapour may be mixed with other vaporous or gaseous substances, such as for instance ammonia, formaline, sulphur dioxide, alcohol, carbonic acid, which substances may have an entirely other action, for instance a hardening action on the threads, than the steam or water vapour.

The most simple way of putting the process of my invention into praxis is to subject the threads still in highly swollen condition to the action of steam or water vapour, for instance on their way to the cutting device or the spooling device, or on the spooling device itself while the thread is still under some tension. Moreover it is also possible to carry out the treatment with the threads being on profiled rollers or the like and in this way the fibres may be fixed in a curled condition.

In my invented process it is not necessary to obtain a high temperature by means of the water vapour since the favorable action already is effected at approximately 40°C, i.e. a temperature at which it may be assumed that condensation takes place on the thread or fibre.

Obviously the action of the steam or water vapour may be obtained by directing the steam jet to the thread or fibre, but also the thread or fibre may pass a room in which a damp more or less warm atmosphere prevails, which is preferably obtained by blowing in steam. The spooling devices or the like may be arranged, if desired, in this moist chamber.

A further advantage obtained by the process of my invention consists herein that also the mechanical properties of the products obtained by wet spinning protein solutions are highly improved by the treatment of my invention. For instance casein threads not being treated with steam have a shrinkage of 30 to 60%, depending on the spinning method applied, whereas treated with steam but maintaining for the rest the same conditions, these threads may have a shrinkage of 6 to 12%. If after hardening in formaline baths and drying the strength of these threads is determined it appears that in the first case the strength amounts to approximately 45 to 60 and in the second case to 70 and more.

By my invention not only an extremely important improvement of spun protein products is obtained, but I succeeded in an amazingly simple way to give the products more normal properties.

My invention is applicable to the spinning of solutions of casein and other animal or vegetable proteins suitable or rendered suitable to this effect, such as for instance soya proteins, fish proteins, mixtures of these proteins and also to mixtures of these proteins with each other and/or with viscose. This spinning takes place in the usual way, i.e. a solution of the protein, generally in an aqueous solution of an alkaline substance, e.g. sodium hydroxide is spun in an acid spinning bath, e.g. an aqueous bath of mineral or organic acids and if desired salts. Obviously my process is not restricted to the treatment of fibres or threads, but it is also applicable to other articles of manufacture, for instance films and moreover my process is not restricted to the above given examples but also other suitable methods of treatment with steam or vapour come within the scope of my invention as will be obvious to the expert.

GEORGE STEPHAN DE KADT.

Published Apr. 27, 1943

Serial No. 257,030

ALIEN PROPERTY CUSTODIAN

PROCESS FOR SPINNING PROTEINS

George Stephan de Kadt, Leeuwarden, the Netherlands; vested in the Alien Property Custodian

No Drawing. Application filed February 17, 1939

This invention relates to an improved process for producing articial fibres such as filaments, threads and the like by spinning protein solutions, particularly casein solutions.

Protein solutions coming into consideration for spinning fibres are prepared by dissolving proteins suitable or rendered suitable to this effect, for instance casein or other animal or vegetable proteins, such as fish proteins and soya protein, in diluted alkaline solution. Moreover inorganic or organic substances may be added to these solutions, which substances influence the spinning process or the products obtained in some way or other. Such a solution is then spun in an acid spinning bath, consisting as generally known of solutions of strong acids, salts and if desired organic substances. Also spinning baths have been proposed, consisting of mixtures of alcohol and organic acids. Since these latter baths are however impractical and uneconomic the first mentioned baths are generally preferred.

It has, however, not sufficiently been realised, that proteins are amphoteric substances maintaining also in strongly acid medium a certain hydration degree and which therefore insufficiently dehydrate in the above-mentioned spinning baths. The result is with such baths 1° that an insufficient spinning speed is obtained, 2° the stretching of the thread is restricted and 3° the fibre has a very high shrinkage resulting into fibres which after this shrinkage having ended its action, may be more than 100% thicker than the fibres obtained during spinning.

Obviously these three drawbacks will not appear in the same degree with all compositions of spinning baths. Thus the following data were found by spinning a 16%ic casein solution:

Spinning bath	Temp.	Maximum spinning speed to be obtained	Minimum denier to be obtained	Shrinkage of the freshly spun product in per cent of the length spun
	°C.	M/min.		
6% HCl 20% Na_2SO_4	50	53	2.6	53
22% H_2SO_4 15% Na_2SO_4	50	60	2.0	55
5% H_2SO_4 20% Na_2SO_4	50	53	2.3	58
22% H_2SO_4 5% Na_2SO_4	50	66	2.6	55
10% H_2SO_4 30% NaCl	50	85	1.9	60
2% HCl 10% $CaCl_2$	50	50	2.5	60

These figures sufficiently show the drawbacks of the above type of spinning bath and it will be clear that it is of great importance to provide for a spinning bath type having these drawbacks not at all or in much less degree.

By my invention I succeeded in this respect by making use of spinning baths consisting of a solution of organic and/or inorganic salts to which only such an amount of one or more organic acids has been added, that the pH value of the spinning bath is more than 2 and preferably above 2,7 or even above 3,0. The spinning bath may according to my invention also consist of a solution of organic salts with or without inorganic salts, to which only such an amount of inorganic acid and if desired organic acid is added that the pH value of the spinning bath is more than 2 and preferably above 2,7 or even above 3,0.

Moreover the spinning baths according to the invention may contain organic substances substantially not influencing the pH value, such as for instance alcohol, glycerol, glucose, urea and the like.

Though the pH value of these baths comes very close to the isoelectric point of casein i. e. the point at which the hydration of casein should be a minimum and which corresponds to a pH value of 4,6 to 4,7 I have found by many experiments that besides the low acidity also the salt contents is of considerable importance since the spinning bath which for instance only contains organic acid is without salt not at all utilisable for spinning or gives very unsatisfactory results.

An example of a spinning bath for use according to my invention is an aqueous solution containing 5% of lactic acid, 5% of sodium lactate and 15% of magnesium sulfate.

An example of a spinning bath with a pH value above 3 (namely approximately 3,4) which gave extraordinary good results when spinning a 16%ic casein solution, is a bath consisting of a solution of 6% of acetic acid and 20% of sodium sulfate, to which small quantities of acetates may be added without giving an appreciable difference.

When using such a bath (for the rest under the same conditions as above mentioned) the following data were obtained:

Spinning bath	Temp.	Maximum spinning speed to be obtained	Minimum denier to be obtained	Shrinkage of the freshly spun product in per cent of the length spun
	°C	M min.		
6% aceticacid 20% Na_2SO_4	50	120	[illegible]	[illegible]

The fibres so obtained were of very good quality.

As examples of protein solutions to be spun I mention solutions of casein and of other proteins suitable or rendered suitable to this effect and of animal or vegetable source as well as mixtures of protein solutions with viscose. If desired the threads may be subjected to a fixation afterwards.

GEORGE STEPHAN DE KADT.

Published Apr. 27, 1943

Serial No. 257,508

ALIEN PROPERTY CUSTODIAN

GUNS HAVING SLIDING AND EXCHANGEABLE BARRELS

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Application filed February 20, 1939

In guns having exchangeable barrels, barrel-securing devices are known which automatically prevent a shot being fired when the barrel is not properly positioned in the gun or when the barrel is not properly locked. In the known arrangements a safety member, influenced by the coupling of the breech casing to the barrel, immediately locks the breech mechanism when the barrel is imperfectly coupled with the gun, so that it is impossible for the gun to be loaded unless the barrel has been coupled satisfactorily.

Furthermore, it is known in connection with guns having a sliding and exchangeable barrel to couple the barrel and a locking sleeve in such a manner that a guide member mounted in the gun casing engages, in the coupling position, in longitudinal grooves in the barrel and thus axially locates the barrel.

The invention is concerned with the problem of providing an improved safety-device of the last named type in such a manner that the manipulation of the safety-device itself and also of the barrel is simplified by means which control the assembling and dismounting movement. According to the invention, with this object in view at the rear end of the known longitudinal groove there is connected a guide groove which affords positive guidance to the barrel over the entire course of its assembling and dismounting movement, and in which the guide member can enter after having been removed from the longitudinal groove. When the guide groove is given a suitable shape, by means of the invention an improvement in such barrel safety-devices is obtained, which is intended to prevent the gun from being cocked when the barrel has not been completely coupled, in that the barrel is prevented from being clamped while it is imperfectly coupled—which is possible with the known safety devices. This result is obtained by the guide groove first running transversely to the longitudinal groove on the barrel in accordance with the length of the locking teeth, and then parallel to the said longitudinal groove as far as the rear end.

The engagement of the axial guide for the barrel forming the conclusion of the mounting of the barrel, calls attention from the outset to the proper or improper performance of the locking of the barrel. If the axial guide for the barrel does not engage—owing to a faulty barrel coupling or accidental omission owing to lack of attention, the guide in conjunction with the transverse groove of the barrel prevents the barrel from being moved back for the loading process, and thus compels the gunners first of all to bring the barrel fixing into a satisfactory coupled state.

The drawings illustrate a typical embodiment of the invention, namely a large-calibre machine gun having a sliding barrel, a locked breech, and a barrel fixing of the bayonet catch type.

Fig. 1 shows a longitudinal section through the middle part of the gun.

Fig. 2 shows a cross-section at the level of the axial guide for the barrel, and

Fig. 3 is a plan of the barrel showing the arrangement of the assembly and dismounting grooves on the gun casing.

The barrel a of the gun is adapted to be removed from the gun casing c either alone from the front in known manner, or from the rear together with the breech casing b, and the breech block d which is adapted to be locked thereto. The breech block is locked in a manner which is usual in guns of the kind in which the breech block d does not open in order to eject a fired cartridge or for loading, and also just after a change of barrel has been made, until it has covered a certain distance in the backward direction, in the condition in which it is closed and locked with the breech casing b and the barrel a.

In order that it may be fixed in position the barrel a has, at its rear end, two uniform rows of bayonet catches or teeth distributed over its periphery, which locking teeth when the barrel a has been inserted in the proper manner, engage over their entire width with counter teeth b_1 on the breech casing b, this casing being so arranged as closely to embrace the barrel at its front portion over a considerable length.

In the coupled position shown in Fig. 1 the barrel a is secured by a locking pin e which is mounted in the gun housing, and, under the influence of a spring e_1, is thrust inwards so as to locate a projection e_2 in a slide groove a_2 and thus axially position the barrel. The projection e_2 consists of a guide shoe the width of which corresponds to the width of the guide groove a_2, but having a greater length, the shoe being obtained in the example shown by flattening two sides of a cylindrical head.

On the knob f of the pin e which projects from the gun casing c, there are provided projections f_1 which engage in corresponding notches in the gun casing c and thus secure the shoe e_2 in the position necessary to enable it axially to guide the barrel. By raising the pin e against the pressure of the spring e_1 until the projections f_1 disengage from the notches in the casing, the knob f with the pin e can be turned, and after

turning through 90° can be fixed in a raised position which brings the foot of the shoe e_2 in alignment with an assembly or dismounting axially transverse groove g on the barrel casing.

For this purpose, as may be seen from Figs. 2 and 3, there is provided at the intersection of the longitudinal groove a_2 and the peripheral transverse groove g a cylindrical recess a_3 the diameter of which corresponds to the maximum superficial or longitudinal dimension of the shoe e_2, and the depth of which is such that the walls of the recess extend to the base surface of the groove which runs longitudinally on the barrel casing. The arrangement of the recess a_3 and the projections f_1 permits of the turning of the shoe e_2 into the position necessary to enable the barrel to be changed and in this position the base surface of the shoe e_2 is raised level with the bottom of the transverse groove g, but is not high enough to be flush with the peripheral surface of the barrel. The sliding shoe e_2, when in the raised and turned position, thereby forms, in the assembly and dismounting of the barrel, an abutment that prevents the barrel from being drawn back when the coupling of the barrel has not been properly carried out and secured and thus precludes the possibility of the gun being loaded in such case. To the transverse groove g, there opens a longitudinal groove g_1 which extends towards the rear end of the barrel, the length of the groove g depending on the peripheral length of the locking teeth a_1 on the barrel while the width of the groove g_1 corresponds to the greater or longitudinal dimension of the slide shoe e_2.

It is possible for the barrel to be removed from the front only when the various gun members are in the front end position as otherwise the axial locating member e_2 would not lie opposite transverse groove g. After the pin e has been raised and turned through 90°, the slide shoe stands in the position shown in Figs. 2 and 3, i. e. with its narrow side disposed to the groove g so that an unbolting, pivotal movement of the barrel a can take place. The disengagement of the barrel teeth a_1 from the counter teeth b_1 in the breech casing is completed as soon as the longitudinal groove g_1 of the barrel, which extends rearwards at right angles to the groove g, comes opposite the shoe g_2. Any further pivotal movement of the barrel in the unlocking direction is thus prevented. Now, the barrel can be drawn forward axially and withdrawn from the breech casing b and, therefore, from the gun.

A new barrel can be inserted only when it occupies an angular position which is determined by the guiding of the slide shoe e_2 in the longitudinal groove g_1, when, the breech casing being in its forward end position in the gun, the insertion of the barrel automatically brings the teeth a_1 opposite the gaps of the locking teeth b_1 of the breech casing b. The limitation of the inward movement of the barrel, to the position in which the teeth of the barrel a and of the breech casing b are correctly relatively disposed to enable the barrel and breech casing to be locked together, which is effected by the striking of the shoe e_2 against the front wall of the transverse groove g, prompts the turning movement necessary for the locking operation. When the barrel attains the completely coupled position, this position is indicated by the abutment of the shoe e_2 against the walls of the circular recess a_3. If now the shoe e_2 is turned back through 90° until the projections f_1 engage in the grooves in the casing, the barrel a is fully secured and the gun is again ready for loading.

In the present case the locking teeth on the barrel a and the breech casing b have no screw pitch, so that when the barrel is inserted its linear inward movement is limited by the rear end of the barrel striking against the shoulder b_2 of the breech casing b.

If the locking teeth of the barrel a and the breech casing b have a coarse screw pitch, for instance in order to loosen the cartridge case during the unbolting operation, then, naturally, the transverse groove g must also be given a corresponding inclination. In this case the barrel would be prevented from being inserted further than the proper locking position merely by the co-action of the shoe e_2 and the groove g.

KARL KEHNE.

PUBLISHED

APRIL 27, 1943.

BY A. P. C.

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GUNS HAVING SLIDING AND
EXCHANGEABLE BARRELS
Filed Feb. 20, 1939

Serial No.
257,508

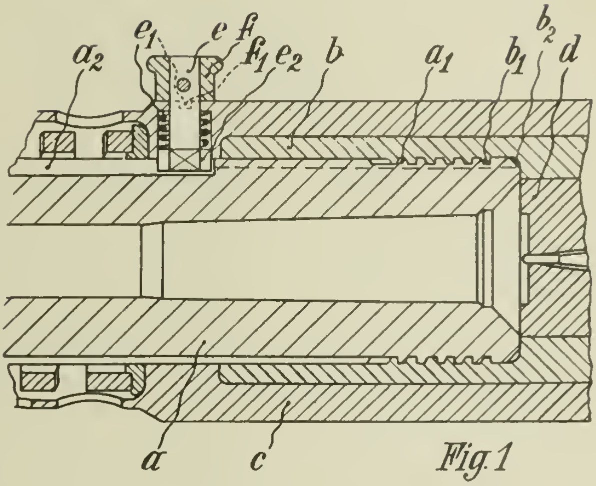

Fig.1

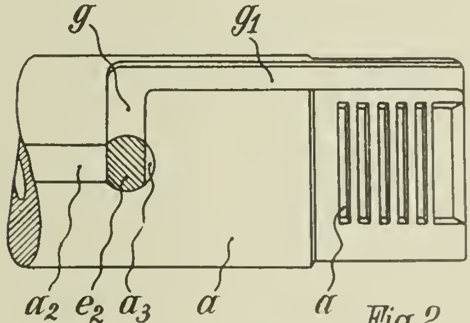

Fig.2

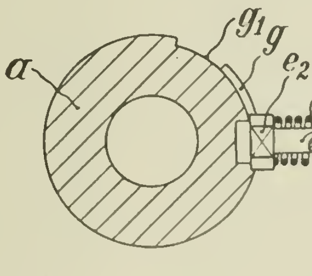

Fig.3

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Published Apr. 27, 1943

Serial No. 257,533

ALIEN PROPERTY CUSTODIAN

GRIP FOR FIRE-ARMS, ESPECIALLY PISTOLS, AND METHOD FOR THEIR PRODUCTION

Johannes Schwarz, Berlin-Dahlem, Germany; vested in the Alien Property Custodian

Application filed February 20, 1939

Hitherto the grips and breech-slides, magazine-guides, drum-holders and the like integrally connected therewith in the usual manner have been machined, with tools for removing splinters, from wrought pieces or solid material, obviously with the assumption that the grip is in places very much strained and consequently must be especially hard. This method is very lengthy and expensive. Lightmetal grips produced by sand-casting and heavily machined have not stood the test in consequence of too little surface-hardness and strength.

The invention consists in the grip, and the housing-parts integrally connected therewith, such as slides, magazine-guides, drum-holders and the like being produced by die-casting essentially in its final form without tooling its inner and outer surface, preferably with the employment of easily fusible metals, such as hard aluminium alloys and especially zinc alloys, e. g. consisting of about 91–94% Zn., 3.5–5% Al., and 2.5–4% Cu. By this means the production of the grip is exceptionally accelerated and simplified, as external subsequent machining of the cast grip is almost wholly dispensed with. The above described zinc alloys show themselves to be of especial value for the new casting, because they are cheap and easily fusible and have therewith a tenacity value of about 33–36 kg/mm^2 and furthermore at the surface a high Brinell-hardness (112 kg/mm^2) and a favourable capacity for sliding relative to steel. Grips of such or similar heavy metal castings have the further advantage that their weight scarcely differs from that of iron-grips and consequently, when firing, the weapon lies in the hand quite as well as a weapon with an iron-grip. In certain cases also easily fusible gunmetal (hard solder alloy) and under certain circumstances white cast-iron are applicable, which can be converted later into forgeable iron with the employment of appropriate additions of carbon, manganese, and silicon by a simple heat-treatment known per se.

An advantageous form of manufacture is that wherein polished cores are inserted in the mould at the places at which the casting is to have sliding surfaces.

By this means on casting the surfaces are already so smooth that a subsequent machining at these places is unnecessary.

According to another way of carrying out the manufacture in accordance with the invention, pieces made of difficultly fusible metal are placed in the mould before casting at places in the casting at which it is to have sliding surfaces. These pieces are embedded in the cast metal and may either have the final shape before casting, e. g. a U-cross-section, or they may have a full cross-section and be machined in the finished casting.

The figure in the drawing illustrates in perspective view one form of grip made in accordance with this invention namely a grip for an automatic pistol.

In the figure the grip consists of a butt 1, which comprises the magazine guide 2 and the holes 3 for spring and trigger parts and the guard 4 for the trigger. In the upper part of the grip is provided a slide 5, together with an attached arcuate slide piece 6, for the reception of the breech and barrel sliding therein.

In making such a grip of a hard zinc alloy consisting of about 91–94% Zn, 3.5–5% Al, and 2.5–4% Cu the whole grip including the sliding surfaces can be cast in a completely finished state without a machining at the sliding surfaces being necessary for the removal of splinters. Suitably, however, a protective layer is applied at all places, which do not serve as sliding surfaces, e. g. by electric oxydation or by applying a lacquer and burning it in.

Instead of zinc-alloys there can be employed for example an easily fusible yellow-or red-metal e. g. a hard-solder alloy. Both alloys have a weight similar to iron, so that the weapon remains in its total weight practically unchanged as compared with iron.

When light metal is employed suitably the slides 5 and 6 are embedded in the casting, the slides being made as special work-pieces in final form or a form subsequently to be machined.

JOHANNES SCHWARZ.

PUBLISHED

APRIL 27, 1943.

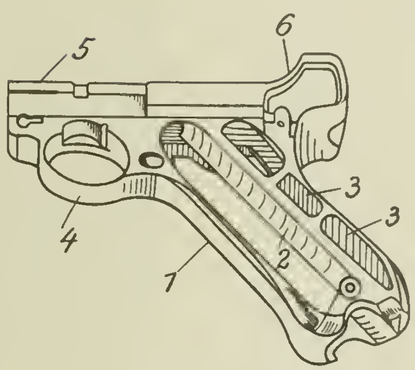
BY A. P. C.

J. SCHWARZ

GRIP FOR FIRE-ARMS, ESPECIALLY PISTOLS, AND METHOD FOR THEIR PRODUCTION

Filed Feb. 20, 1939

Serial No. 257,533



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Published Apr. 27, 1943

Serial No. 257,546

ALIEN PROPERTY CUSTODIAN

POWER TRANSMISSION ELEMENTS

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No Drawing. Application filed February 20, 1939

This invention relates to power transmission elements such as driving belts and cables, conveyor belts and the like; it is an improvement in the invention described and claimed in the copending application for Letters Patent of Herbert Berg and Bruno von Zychlinski, Serial Number 177,651, filed December 1, 1937.

Frictional power transmission devices such as driving belts and the like are usually made from such materials as leather, rubber, textile fabrics and the like. Such belts have certain shortcomings, among which may be mentioned a tendency to become glazed on their friction surfaces, thereby resulting in slippage of the belt with consequent power loss; the fact that they tend to develop cracks and fissures after long continued flexing; the fact that they tend to pick up static electrical charges which, upon discharge, constitute a fire hazard if combustible materials are present in the vinicity; and the fact that oils and greases exert a deleterious action upon them causing slippage and deterioration of the belt material.

According to the aforementioned co-pending application, conveyor belts and the like which are free from most of these disadvantages may be obtained by the utilization of hydrophilic polyvinyl alcohol compounds which constitute at least a substantial part of the frictional surface. Thus, such power transmission belts may be conveniently prepared merely by coating or impregnating the usual known types of belts with a solution of a hydrophilic polyvinyl compound with water or other suitable solvent. Upon removing the solvent, as by drying, either at ordinary or elevated temperatures, a film of the hydrophilic polyvinyl compound is deposited. Alternatively, a sheet or film of a hydrophilic polyvinyl compound may be prepared separately and adhesively united to the surface of the belt. It may also be advantageous to prepare the belt entirely of a hydrophilic polyvinyl compound by molding or extruding, according to known methods, to the desired form. In such cases it is sometimes desirable to incomporate in the element intercalations of textile fibers, metal foils or the like. Fillers such as starch, gelatine and the like may also be included.

The term hydrophilic polyvinyl alcohol compound is used herein and in the appended claims to designate polyvinyl alcohol and partial derivatives thereof which are colloidally soluble or dispersable in water. Such partial derivatives of polyvinyl alcohol may be prepared, for example, by the partial hydrolysis or saponification of polymerized vinyl ester, ethers or acetals. Alternatively they may be prepared by the partial reaction of polyvinyl alcohol with acids, ethers or aldehydes. Preferably those partial derivatives of polyvinyl alcohol are used when from about 5% to about 35% of the hydroxyl groups have been replaced by ester, ether or acetal groups leaving from about 95% to 65% of the free hydroxyl group in the compound.

Although these hydrophilic polyvinyl compounds are soluble or capable of swelling in water, they are not unduly water-sensitive for most purposes. However, if it is desired to decrease their water-sensitivity, they may be treated with various insolubilizing agents. Examples of suitable insolubilizing agents are: aldehydes, certain metal salts, such as dichromates and iron salts, and dye-stuffs of the Congo Red group. The water-sensitivity may also be decreased by heating the compositions or by treatment with alcohols such as methyl or ethyl alcohol.

An object of the present invention is to provide a method for improving power transmission belts or the like of the kind described in the co-pending U.S. application Serial No. 177,651 above referred to, especially with respect to increasing their resistance to cracking upon repeated flexing and with respect to improving their pliability and durability. Another object of the invention is to provide improved power transmission belts and the like of the above described kind. Other objects and advantages of the invention will be apparent from the ensuing description thereof.

The objects of my invention are attained by utilizing as friction surfaces in power transmission elements hydrophilic polyvinyl alcohol compounds which have been modified by the action of acidic substances. Preferably I use as such acidic substances inorganic acids such as sulfuric acid, phosphoric acid, hydrohalic acids, especially hydrobromic acid, acid salts thereof, and mixtures thereof. Also organic acids such as lactic acid, sulfoacids or sulfonates, and trichloracetic acid and mixtures thereof with each other or with inorganic acids may be used.

These acidic substances may be incorporated in the hydrophilic polyvinyl alcohol compounds by compounding them therewith, e. g. prior to coating or impregnating of the power transmission belt or the like. Alternatively such mixtures of hydrophilic polyvinyl alcohol compounds and acidic substances may be formed directly into such power transmission elements by molding or extruding with or without the addition of fillers. I prefer, however, to incorporate said acidic sub-

stances in the hydrophilic polyvinyl alcohol compound by first forming the belt or the like and subjecting the thus formed product to an after treatment with a solution, preferably an aqueous solution, of the acidic substance. In any case the amount of the acidic substance used or the concentration of the acidic solution used or the time of treatment will be dependent on the amount of hydrophilic polyvinyl alcohol compound present in the power transmission belt, on the thickness of the product and on the depth to which the treating agent is desired to penetrate. Thus, for example, in the case of a power transmission belt having a thickness of about 3 mm., immersion for 6–12 hours in an 80% aqueous solution of phosphoric acid will result in a considerable increase in the resistance to cracking on repeated flexing and in improved pliability and durability. Generally, the longer the dipping is continued the more rubber-like will be the properties imparted to the treated driving belts or the like, without however increasing their sensitivity to oils or greases or their tendency to develop electrostatic charges.

It has been found that especially good results can be obtained if, in addition to the acid after-treatment, further acidic substances are initially incorporated in the hydrophilic polyvinyl alcohol compound, or in place thereof, or in addition thereto, plasticizers such as glycerine, glycols, formamide, sulfocyanides and the like. Advantageously also a small amount of mineral oil may be incorporated in the belt material.

My invention is further illustrated by the following examples.

Example I

Polyvinyl alcohol molding powder having a saponification number of 80 (93% saponified polyvinyl acetate), and having a moisture content of about 15%, is introduced into a matrix of box form, the surface of the matrix being provided with an extremely thin surface layer of lubricating oil. The polyvinyl alcohol molding powder is then pressed in a hydraulic press such as is used for the production of rubber belts and is heated to 150 to 170° C. At first the molding powder is pressed for about a minute under a pressure of 12 kilograms per square centimeter to compress it and thereafter the press is opened a little to vent the mold and closed again under a pressure of 12 kilograms per square centimeter. The mold is then heated from the bottom to obtain a uniform temperature of 110° C. throughout the mold (for an article of about 50 millimeters thickness this takes about 6 minutes). The press is then vented again for a short time and is closed again under a pressure of 12 kilograms per square centimeter and heated to about 150° C. The press is kept at this temperature and under this pressure of 12 kilograms per square centimeter for 20 minutes. After suitable cooling the molded strip can be easily removed from the mold and individual molded strips can be united by the application of heat and pressure to form endless bands.

The thus formed endless bands are immersed into a 20% solution of phosphoric acid for 20 hours and thereafter into an 80% solution of phosphoric acid. The thus treated endless bands are then dried and worked into driving belts.

Example II

A 25 to 30% aqueous solution of a polyvinyl alcohol having a saponification number of about 40 (97% saponified polyvinyl acetate) is thoroughly deaerated by heating under a vacuum. The solution is then cast into an endless film of about 5 millimeters thickness by means of a conventional type of casting machine.

The thus formed endless band is then rolled to permanently decrease the thickness to about 3 millimeters. It is then immersed for about 12 hours in an 80% solution of phosphoric acid, dried and worked into a driving belt.

Driving belts, driving cables and other endless belts subject to frictional drives made in accordance with the present invention have a number of advantages even after long continued use. They show no tendency to develop electrostatic charges under any conditions. They are entirely impervious to, and unaffected by, oils and greases. They have a higher resistance to repeated bending and flexing stresses than belts prepared in the same way and having the same composition but having no acidic substances incorporated therein. Moreover, the acid treatment renders the belts less subject to changes in physical properties resulting from variations in the humidity and temperature of the surrounding atmosphere.

HERBERT BERG.

Published Apr. 27, 1943

Serial No. 257,613

ALIEN PROPERTY CUSTODIAN

POWER ENGINE PLANT

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Application filed February 21, 1939

This invention relates to a power engine plant operated with a gaseous working medium, wherein the working medium is compressed in a compressor, then heated in a heat-exchanger by hot gases, then expanded in the power engine and finally supplied to a combustion chamber where the hot gases are produced by means of fuel supplied thereto. It is the general object of the present invention to improve plants of the general kind above described by the provision of an improved heat exchanger, by means of which heat is transferred from the hot gases to the working medium.

Known plants of the above described kind include surface heat-exchangers wherein the heat of the hot gases is transferred to the compressed working medium through metallic walls. These power engine plants have not hitherto been constructed with success because the materials available for the metallic walls could be heated only to about 550° C., if they are simultaneously exposed to mechanical stresses resulting from the pressure difference existing between the hot gases and the compressed working medium. The thermal efficiency in such a case falls so low that the effective output derived from the fuel was substantially nil that is the output of the machine only sufficed to drive the compressor and the useful work was therefore zero.

This invention is based on the understanding that the fuel can be used with advantage only if the transfer of the heat of the hot gases to the compressed working medium can be successfully accomplished under safety conditions of operation at temperatures of about 1000° C. or more. Due to these high temperatures the thermal efficiency becomes so high that an overall efficiency of the fuel can be reached which exceeds those of the steam turbine and equals those of Diesel engines. For this purpose any suitable fuel can be used as well as furnace gas or pulverised fuel.

The high degree of heating of the compressed working medium by the hot gases is effected according to the invention by constructing the heat-exchanger in which the heat of the hot gases is transferred to the compressed working medium as a heat storage member having a plurality of heat storage elements each of said elements in turn receiving heat from hot gases and another of said elements simultaneously giving up heat in turn to the compressed working medium.

After the element of the heat-exchanger heating the working medium has given up its heat, the working medium to be heated is supplied to another element of the heat store which has previously been heated by the hot gases.

The heat storing medium may consist either of kinds of iron alloys or of other materials such as stone. There are, however, kinds of iron alloys which are capable of operating continuously as heat storage bodies up to 1200° C. as they have to withstand no mechanical stresses.

For an understanding of the more detailed nature and objects of the invention and the advantages to be derived from its use, reference may best be made to the ensuing portion of this specification taken in conjunction with the accompanying drawings forming a part hereof.

Fig. 1 shows a plant according to the invention wherein fuel oil is utilised as fuel.

In the plant illustrated in Fig. 2 a combustible gas is supplied to the combustion chamber and in the plant according to Fig. 3 powdered fuel.

Figs. 4–6 show a constructional form of the combustion chamber.

The plant illustrated in Fig. 7 is sub-divided into a closed high pressure circuit in which the working medium circulates between the compressor, one part of the heat store, the power engine, the combustion chamber and another part of the heat store. A part of the working medium is separated out of this circuit and is expanded in another power engine.

In the system shown in Fig. 8 the working medium supplied to the second power engine is removed from the closed circuit in front of the compressor.

In the installation according to Fig. 9 heat still present in the hot gases after leaving the heat store is utilised for steam production.

Fig. 10 shows a further installation having means for controlling the output of the power engine.

Figs. 11–15 show detailed constructional forms of the heat storage and combustion members as well as of the controlling devices.

Referring to Fig. 1 an embodiment is shown in which fuel oil is burnt as fuel in the combustion chamber B and moreover in the presence of exhaust gases of the turbine T which consist of pure air or of air having a certain steam content as will be more fully described below. The combustion gases resulting in this manner in the combustion chamber flow through one or more chambers of the heat store R which are arranged in parallel. The heat still contained in the gases on discharging from the heat store is then uti-

lised as far as possible in surface heat exchangers 23 and 11.

The outer air sucked in by the compressor V is brought by the latter in a plurality of stages to a high pressure, surface coolers 2, 3, 4 being arranged in the usual manner between the individual stages in which the air can give up the heat taken up in the preceding compression stages. A pump 5 forces cooling water through the intermediate coolers 2, 3, 4. The water heated on passing through the surface coolers flows through a conduit 6 to the upper part of the irrigation layer 7 of a saturator S.

The compressed air from the last stage of the compressor V enters the saturator through the conduit 8 and flows through the layer 7 upwardly in counter-flow to the downwardly trickling water. In this way compressed air becomes saturated with water vapour and at the same time the water is cooled down and in this manner is again prepared to take up heat in the surface coolers 2, 3 and 4. The purpose of the saturator S is to transfer the heat removed from the air in the intermediate coolers 2, 3, 4 and transferred to the cooling water wholly or partly back to the air in the saturator.

The water vaporized in the layer 7 is replaced through a float control 9. This additional water which is supplied through the conduit 10 flows through the above mentioned surface heat-exchanger 11 which is heated by the combustion gases leaving the heat store.

The air enriched with water vapours which leaves the saturator S through the conduit 12 passes through one or more store-chambers inserted in parallel and previously heated up by the combustion gases and then flows through the conduit 13 in a considerably heated condition into the turbine T where it is expanded and transfers its energy in the form of mechanical work to the turbine wheel.

The air expanded for example almost to the outer air pressure and considerably cooled down leaves the turbine T through the conduit 14 and is then brought in the above described manner in the combustion chamber to the highest temperature and then as hot gas enters the chambers of the heat store which are to be heated. The heat store R has at least three individual chambers and is operated in known manner so as to bring the chambers periodically and successively into operation. The change over takes place in such a way that after one period in which the storage material is heated up by the combustion gases there follows a period when the same is cooled down by the air to be heated. After the resultant cooling down the particular storage chamber is again changed over for heating up by the combustion gases.

In the individual members of the plant the following pressures and temperatures may for example exist. It may, for example, be assumed that the temperatures of the hot gases on leaving the combustion chamber B are about 1000° C., and that the gas temperature on giving up heat in the heat store R sinks to about 160° C so that the gases flow out of the heat store with the latter temperature.

The fresh air is compressed in the compressor V to about 7-atm.abs. The temperature of the compressed air before entering the heat store R is about 150° C and on leaving the heat store about 950° C. In the power engine T the air expends down to nearly 1-atm.abs. In the expansion nozzles of the power engine which are inserted in front of the blade rim of the impeller wheel the temperature of the air during expansion falls to about 600° C. Due to friction against the blades of the impeller wheel the temperature again rises somewhat so that it leaves the power engine T at nearly 1 atm.abs. at about 650° C., and enters the combustion chamber B.

In the construction shown in Fig. 2 gaseous fuel is utilised for heating the combustion chamber B. In this case it is preferable to pre-heat the combustible gas in a heat-exchanger 16 which is heated by waste gases from the power engine T, which as above described, consists either only of air or of air with a definite steam content. Part of the engine waste gases flows through the conduit 15 to the pre-heater 16 and the remainder is supplied to the combustion chamber B for the combustion of the gaseous fuel. The combustible gases are circulated by the blower 17 which produces only a small pressure above atmosphere, through the pre-heater 16 into the combustion chamber B.

The pre-heater 16 may be constructed as a heat store. However, a surface heat-exchanger may also be used as illustrated in Fig. 2 in which the heat is transferred from the exhaust gases to the gaseous fuel directly through the walls of the exchanger.

In order, on the pre-heating of the combustible gases, to effect a favourable thermal utilisation of the heat of the exhaust gases, the heat-exchanger for the pre-heating of the combustion gases must be dimensioned for such a part of the exhaust gases of the power engine that the product of the weight of this part of the exhaust gases and their specific heat is equal to the product of the weight of the combustible gases and their specific heat; in this case there results at the inlet and outflow sides of both gases the most favourable temperature difference between the two.

If for heating the combustion chamber pulverized solid fuel is chosen, as illustrated in Fig. 3, consideration must be paid to the fact that this fuel must be blown in with air or with a gas mixture containing much air, the temperature of which, however, must not be sufficiently high to cause pre-ignition of the fuel by this air blast. The pulverised solid fuel is, therefore, blown in in a suitable manner with exhaust gases having a high air content which leave the heat store and are consequently strongly cooled down therein.

From a collecting conduit 18 through which pass the exhaust gases flowing out of the store R a part of the exhaust gas is removed and is supplied to a blower 19 which increases the pressure of the cooled exhaust gases sufficiently to operate as an injector into the combustion chamber B and to be able to overcome the resistance of the heat store R. The exhaust gases pass from the blower 19 through a conduit 20 into the top of the combustion chamber B where they are mixed with solid fuel fed from a container 21 by a feeding device 22 and blow said fuel into the combustion chamber B. There the blown in mixture meets the exhaust air supplied through the conduit 14 in which the solid fuel is burnt. The highly heated combustion gases then flow into the heat store R as described in the preceding example.

The manner of the air compression and the enriching of the finally compressed air with water vapours by partial evaporation of the cooling water of the intermediate coolers of the air com-

pressor may be effected similarly as in the embodiment described with reference to Fig. 1. The enrichment of the compressed air with vapours may, however, be further increased by the cooling water which leaves the intermediate coolers 2, 3 and 4 being further heated in a heat-exchanger 23 which is heated by the exhaust gases from the heat store R. These exhaust gases subsequently flow to the heat-exchanger 11 in which the additional water which passes through the float control 9 is pre-heated.

Figs. 4 and 5 show the combustion chamber with the device for supplying the pulverised fuel on a larger scale. Fig. 4 being a vertical section on the section line I—I of Fig. 5 and Fig. 5 being a horizontal section on the line II—II of Fig. 4.

The combustion chamber B is formed with a head 24 in which the pulverised fuel mixes with the air blast. This air blast supplied through the conduit 20 enters the mixing head 24 tangentially. The pulverised fuel which is present in the storage chamber 21 falls from the lower part of this storage chamber in regulatable amounts. The amount so delivered may be controlled by the vertical position of a vertical rotating shaft 25. The lowest part of this shaft 25 is constructed in the form of a valve whilst above this part the shaft has a cross-section which is non-circular and non-uniform. Due to this and by the rotation of the shaft arching of the mass of pulverised fuel in container 21 is prevented with the result that the downwardly directed movement of the pulverised fuel continues without interruption. The fuel dropping from the container 21 passes into a chamber located below the same and fitted with the feeding device 22 by which it is moved to the left until it reaches the conduit 26 in which it falls downwardly. At the lower end of the conduit 26 the fuel is carried along by the blown in air and passes mixed therewith into the actual combustion space 27 of the combustion chamber B.

The hot air coming from the turbine T is supplied to this combustion space 27 through the conduit 14 which opens tangentially into the housing of the combustion chamber B. The air then passes through guide blades 28, which overlap at their ends with the result that only a part of their surface is exposed to the heat radiation of the combustion taking place in the combustion space 27 whilst the remaining surface is contacted by the very much cooler gases which are supplied through the conduit 14 and are thereby cooled. Further, a part of this gas passes through the upper annular opening of the combustion space 27 which is preferably provided with screw-shaped blades 29, into the combustion space and thereby cools the upper bounding wall 30 of the combustion chamber B. These screw-shaped blades also overlap in a similar manner as the blades 28, as can be seen from Fig. 8. The highly heated combustion gases flow out of the combustion chamber B through the outlet branch 31 and pass to the heat store.

It is well known that the output of a heat engine may be considerably increased if the inlet pressure and the outlet pressure are increased while the temperatures remain constant. If, for example, in a turbine the pressure on entry into the turbine amounts to 7 atm.abs. whilst the outlet pressure is 1 atm.abs. the output of this turbine will be increased three-fold if the pressures are increased three times, that is if the pressure in front of the turbine amounts to 21 atm.abs. and the outflow pressure to 3 atm.abs. If the temperatures in front of and behind the turbine are the same as in the first case three times the weight of the driving medium pass through the turbine. Use is made of this relation in the plant illustrated in Fig. 7.

The main part of the gases exhausting from the turbine T_1 in the plant shown in Fig. 7 flows through the conduit 14 to the combustion chamber B with a pressure now higher than atmospheric. Here the gases are heated in a manner more fully described below, pass into the heat store R where they give up their heat and are further cooled down in the heat-exchangers 23 and 11. From the latter, however, they do not pass into the atmosphere but are supplied to a washer W in which they are freed from impurities and moreover both from dust-like impurities and also from any acid constituents. This is preferably effected, for example by a percolation layer 32 formed of percolation bodies which are sprayed from above by an alkaline solution (for example lime water) whilst the gases to be cleaned flow through the liquid trickling down in counter-flow from below upwardly through the layer 32.

From the washer W the purified gases are supplied to the air compressor V_1 which compresses them and forces them to the turbine T_1. The devices by which the purified gases are compressed and are transferred to the power engine T_1 are constructed in a similar manner to the devices illustrated in Fig. 1 for compressing and conveying the air. The lime-water of the washer W may be circulated in a circuit by the pump 33 and according to the desired action it may be heated up in a heat-exchanger 34 or may be cooled. According to the acid content of the gases it may be advisable to remove a larger or smaller part of the alkaline solution from this circuit and to replace the same by fresh lime-water which can be effected by a float control.

If a plant is operated in this manner, the oxygen content of the gases always moving in a closed circuit into the combustion chamber B would very soon be consumed. In order to maintain the plant continuously in operation it is, therefore, necessary to remove a part of the gases from the circuit and to replace the same by new oxygen-containing air by which the fuel in the combustion chamber is burnt.

The gases to be led away, which are not yet completely expanded are conveyed through a conduit 35 which is branched off from the conduit 14 into a turbine T_2 in which they are expanded to atmospheric pressure. The exhaust gases therefrom are supplied through a conduit 36 to a heat-exchanger 37 which serves for heating up the compressed air. As the latter deals with considerably lower temperatures than the heat-exchanger R, this heat-exchanger 37 may also be a surface heat-exchanger. After the exhaust gases have traversed surface heat-exchangers 38 and 39 they pass into the atmosphere.

In order to replace the exhaust gases which are removed from the high-pressure circuit through the conduit 35 by fresh air, an air-compressor V_2 is provided which sucks in atmospheric air and forces the same through the conduit 40 into a saturator S_2. The air charged with vapours in the saturator S_2 and heated in the heat-exchanger 37 then flows into the combustion space. The air thus supplied facilitates the combustion of the fuel supplied, for example by the fuel oil pump 41. The intermediate coolers of the air-compressor V_2 are provided in a similar manner with circulating water as in the plant according

to Fig. 1, but here also the cooling water leaving the intermediate coolers may be heated additionally in the heat-exchanger 33. The additional water is pre-heated in the heat-exchanger 39 and supplied through a float control 42 to the saturator S_2 in which the water is cooled down.

In the above described system the highest temperature exists in the combustion chamber B in which the low pressure of the high pressure circuit prevails. The temperature of the gases in the conduit 13 which have been heated in the heat store R is only slightly less. These gases are at the high pressure of the high pressure circuit and are expanded whilst doing work in the turbine T_1 to an intermediate pressure which is the low pressure of the high pressure circuit and are thus cooled down to an intermediate temperature.

With this mean temperature and pressure the part of the gases removed from the high pressure circuit through the conduit 35 enters the low-pressure turbine T_2 to be expanded to about atmospheric pressure.

One disadvantage of the process of operation of this system is that the low pressure part of the system operates with a more unfavourable thermal efficiency than the high pressure part since the low pressure turbine T_2 is impacted by driving gases of lower temperature than the high pressure turbine T_1. This may be overcome by raising the temperature of the gases driving the low pressure turbine T_2 by the supply of heat to these gases before their entry into the low pressure machine T_2. The heat supply may be effected in different ways. For example, the low pressure turbine T_2 may be connected, not to the conduit 14 which extends from the high pressure turbine T_1 to the combustion chamber B, but to that conduit through which the hot gases flow out of the combustion chamber B. In this case the low pressure turbine T_2 will be driven by the hot combustion gases.

A separate combustion chamber may also be arranged for the gases to be supplied to the low pressure turbine T_2. This additional combustion chamber is inserted in a suitable manner in the conduit 35 branched off from the conduit 14 and leading to the turbine T_2. The air necessary for burning the fuel in the additional combustion chamber is removed in a suitable manner from the air conduit leading from the pre-heater 37 to the main combustion chamber B.

The advantage of the higher gas temperature in front of the low pressure turbine T_2 is offset mainly by the disadvantage that the driving gases contain impurities which enter the gases during the combustion. This disadvantage may be avoided by transferring the heat of the hot combustion gases to the driving medium of the low pressure turbine through the intermediary of a heat storing device having a number of parts as illustrated in Fig. 8. The driving gases intended for the low pressure turbine T_2 are removed from the main stream of the gases above the washer W through a conduit 43 and are supplied to a multiple-element heat store R_{II} which similarly to the store R_I is heated by a part of the combustion gases from the combustion chamber B. The driving gases supplied to the low pressure turbine T_2 are in this manner brought to the same temperature as those in the high pressure turbine T_1.

In the system according to Fig. 8 there is provided for the heating of the compressed air produced by the compressor V_2 instead of the surface heat-exchanger 37 of Fig. 7, a heat store R_{III} in which the compressed air is heated to practically the same temperature as that of the gases flowing out of the high pressure turbine T_1.

The system illustrated in Fig. 8 has also in the low pressure part a high thermal efficiency, since the low pressure turbine is also impacted by gases at temperatures of about the same value as the higher pressure turbine T_1. If the expansion ratio in both turbines is the same, for example in a high pressure turbine T_1 from 49 atm.abs. to 7 atm.abs. and in the low pressure turbine T_2 from 7 atm.abs. to 1 atm.abs. and thus have a ratio of 7:1 the outflow temperatures from the turbines in the conduits 14 and 36 will be about the same. The air preheated in the heat store R_{III} will be heated nearly to this temperature.

A particularly simple construction of the low pressure part of the system is obtained if the combustion gases to be replaced and removed from the high pressure circuit are as in Fig. 7 removed from the exhaust gas conduit of the turbine T_1 and are, however, supplied not directly to the turbine T_2, but as shown on Fig. 9 firstly through a heat-exchanger 37 and then to the turbine T_2. Here the gases are expanded to the outer pressure as far as possible adiabatically, and are then expelled at a lower temperature into the atmosphere.

The compressed air is compressed adiabatically in the compressor V_2 to the combustion chamber pressure then heated in the heat exchanger 37 which may also be a heat store and so supplied to the combustion chamber. This particularly simple construction is advisable especially when the low pressure of the high pressure circuit is not particularly high, so the adiabatic air compression then only leads to moderate temperatures. If gaseous fuel is used this in like manner should be compressed. The load of the low pressure compressor or compressors with a system according to Fig. 9 is greater than the output of the low pressure turbine T_2 so that, therefore, the high pressure part of the system must give up part of its output to effect the low pressure compression.

In a plant provided with a high pressure circuit and a gas washer W, as for example shown in Fig. 7, the gases passing into the washer W are in general so warm that the washing water leaves the latter at over 100°C. In order to cool it down and to include the heat thus released for power production, the water heated in the washer W as shown in Fig. 9 is relieved of pressure in a chamber E wherein a much lower pressure exists than in the washer W, for example about atmospheric pressure although it may be somewhat higher or lower. On relieving the water of pressure it is cooled down with the evolution of vapour to the boiling temperature at the pressure prevailing in the chamber E for example with atmospheric pressure to 100°C.

The resultant vapour passes through conduit 52 to a super-heater 53 which is heated by the exhaust gases of the heat store R and then to a low pressure steam turbine T_3. From this the expanded exhaust steam flows into a condenser K. The condensate is circulated by a pump 54 at the pressure of the water running out of the pressure releasing chamber. Together with the latter the condensate is forced by the pump 55, if necessary through a filter F, into the upper part of the washer W.

From the water pressure conduit 56 leading to the washer W a branch conduit 57 may be led to the intermediate coolers 2, 3 and 4 of the com-

pressor V_1 which are traversed by the cooling water in series or preferably in parallel. The water heated in the same passes through the conduit 53 to the pressure relieving chamber E where it is again cooled down to for example 100°C with the formation of steam.

A float valve 59 in the lower part of the washer W maintains a constant water level therein since it allows only so much water to run away to the pressure relieving chamber E as passes into the upper part of the washer container.

A float valve 60 in the lower part of the pressure relieving chamber E controls the supply of fresh water which is particularly necessary if a part of the circulating water runs away continuously through an adjustable drain 61 in order to prevent the circulating water becoming too concentrated with salts.

In the washer W in front of the outflow of the gases and in the pressure relieving vessel E in front of the outflow of the vapour therefrom there is arranged a water separator of known construction (not illustrated).

For controlling the output produced by the power engine it is preferable to vary the temperature of the working medium (compressed air) entering the power engine. This is effected in accordance with the invention by dividing the heat-storage devices into two multiple-element storage members one of which is heated to a lower temperature than the other and by providing means by which the amounts of air heated in the two storage members to different temperatures can be mixed in regulatable proportions. Preferably one storage member is heated by the working medium exhausting from the power engine and the other storage member by the combustion gases flowing out of the combustion chamber.

In Fig. 10 such a plant is digrammatically illustrated. It differs from the system shown in Fig. 2 only by the provision of two heat storage members 110, 110′ which are heated in different ways and each of which consists of three separate compartments. The air expanded in the power engine T flows with a temperature of, for example 650° into the conduit 94 from which it flows in part through the conduit 98 into one or two compartments of the store 110′. Another part of the exhaust air from the power engine passes to the combustion chamber B where it comes in contact with the combustible gases supplied by the blower 97 and heated in the surface pre-heater 96. This pre-heater 96 is heated by another part of the exhaust air. The combustion gases formed in the combustion chamber B and heated, for example to 1100° C., pass through the conduit 99 into one or two compartments of the heat store 110 and thereby heat this store. The entire expanded air exhausting from the power engine T, including the combustion gases cooled down in the pre-heater 96 and the combustion gases formed in the combustion chamber B, collect in the conduit 83 and pass, after further cooling in the heat-exchangers 84 and 91, into the atmosphere.

The air compressed in the compressor V flows through the saturator S traversed by the cooling water of the compressor and then passes into the conduit 92 from which it passes in part into one or two compartments of the storage member 110′ heated to a lower temperature and in part into one or two compartments of the storage member 110 heated to a higher temperature. The part of the compressed air heated in the heat store 110′ to substantially 650° and the part of the compressed air heated in the heat store 110 to substantially 1100° C. pass into the conduit 93, are here mixed and flow at a mean temperature to the power engine T in which they are expanded.

The value of this mean temperature of admixture may be regulated by controlling the proportion of the amount of air which heats the store 110′ relatively to the amount of air which is supplied to the combustion chamber B and as combustion gases heat the store 110, as well as by regulating the proportion of the amounts of compressed air supplied to the two stores. It is thus possible by varying the ratio of said amounts to control the temperature of the compressed air flowing through the conduit 93 to the power engine T without altering the temperature ratios of the two heat stores.

Each heat storage member must consist of at least three compartments each of which is heated or cooled down alternately so that the heating gases and also the air to be heated always have a free passage therethrough.

In Figs. 11–15 are more fully illustrated members of a plant according to Fig. 10 especially the storage and combustion plant as well as the regulating system.

The hot compressed air heated, for example to 950° C. at a pressure of for example 7-8 atm. abs. flows through the pipe 102 vertically upwards to the hot air engine which may be a turbine or a piston engine. There the compressed air is expanded to nearly atmospheric pressure so that its temperature sinks to 650° C. With this pressure and temperature the air flows through the exhaust air conduit 103 downwardly to the chamber 104 where the exhaust air stream is divided into a central portion which contacts with the hot surfaces of a heat-exchanger 105 and an outer portion which is led downwardly through the annular space 106.

For the annular space 106 the expanded exhaust air flows through a number of, for example nine, radial tubular sockets 107 into the chamber 109 of the heat store 110 or 110′ controlled by a valve 108. The heat stores 110 and 110′ differ from one another by the heat store 110 being provided with a connecting conduit 111 for a combustible gas whilst in the heat stores 110′ this connecting conduit is either dispensed with or closed. Of the nine heat stores arranged in a ringaround the waste air conduit 103 six heat stores 110 have their own combustion chamber. The stores are preferably so arranged that two stores 110 always alternate with one store 110′. This manner of sub-division is only cited as an example and relates to an embodiment wherein furnace gas is used.

In the heat stores 110′, to which no combustible gas is supplied, the exhaust air heated to about 650° C. flows during that period when the storage material 112 should be heated up, out of the tubular branch 107 through the open valve 108 into chamber 109. From the latter it flows through the cone-shape widened passage 113 into the annular chamber 114 from which it flows into the storage mass 112 which surrounds the combustion chamber and consists of horizontal sheet metal layers. Through the small spaces between the individual metal sheets the exhaust air flows from the interior radially outward. In this way the exhaust air gives up its heat to the storage mass consisting of metal sheets and flows considerably cooled down into the chamber 115 which is arranged with its upper part in the form of a

ring around the storage mass 112. In the chamber 115 the cooled down air flows downwardly into the inner space of the piston slide valve 116 which is shown in its middle position. If it is located in its upper position the cooled down air can flow through the upper ring of openings of the slide valve casing 117 into the space 118 and thence into the withdrawal conduit 119.

When the metal plates which form the storage mass 112, and which in known manner are formed with interruptions in the direction of flow, have been heated up sufficiently the valve 108 is closed and the slide valve 116 is brought into its lower position so that it releases the lower openings in the slide valve casing 117. In this way compressed air of, for example 7 to 8 atm. abs. which is supplied through the branches 120 may flow into the space 115 and thence be forced radially inwardly from the outside through the storage material 112 so that this compressed air withdraws heat from the storage material and is itself heated up and moreover substantially to the temperature for example 650° C, with which previously the expanded exhaust air entered the storage material. The compressed air heated up in this way flows into the chamber 121, raises the valve 122 due to its excess pressure and passes to the annular conduit 123 from which together with the air heated in the other heat stores 110 and 110′ it passes into the conduit 102 extending vertically upward.

When heat has been withdrawn in this manner from the storage material 112 to a sufficient extent the slide valve 116 is again moved upwardly so that it passes firstly into the position shown in Fig. 11 in which it has closed the lower openings of the slide valve casing 117. No more compressed air can thus enter said casing. Consequently the valve 122 falls back on its seating. The slide valve 116 is then moved further upwardly, uncovers the upper openings in the slide valve casing 117 so that the compressed air still present in the chamber 115 can escape to the branches 118 and to the exhaust air conduit 119. As soon as the slide valve 116 has completely uncovered the upper openings in the slide valve casing 117 the valve 108 is also lifted so that again the hot expanded exhaust air can enter from the annular space 106 through the branch 107 into the store 110 and the heating up of the storage material 112 is repeated in the above-described manner.

One difference between the heating up of the heat store 110 as compared with the heating up of the heat store 110′ consists in that the warm exhaust air which passes through the branch 107 to the valve 108 and into the space 109 is here mixed with pre-heated combustible gases which are supplied through the conduit 111. This gas which flows through the conduit 111 is allowed to pass by the valve 124 which operates automatically or preferably is controlled and passes into the annular space 125 and from the latter through the openings 126 into the space 109 in which the jets of the combustible gas flowing through the openings 126 meet the waste air-stream substantially at right-angles. Due to this and to the path of flow which first narrows and finally widens out, efficient admixture of air and combustible gas is produced.

Instead of the gas, liquid or pulverised solid fuel injected by air heated to a lower temperature, may also be used. The mixture of air and combustible gas ignites against the hot walls of the chamber 113, that is unless ignition has not already taken place during mixing on account of the high temperature which, for example lies between 600° and 650° C. During the combustion the temperature rises for example to 1100° C. At this temperature the gases flow out of the annular chamber 114 into the spaces of the heat storage material 112 to which they give up their heat, so that as above-described with respect to the heat store 110′ they are cooled in the chamber 115 and from the latter flow through the slide valve 116 to the outflow branch 118 and thence into the exhaust air conduit 119.

After the heat storage material has been sufficiently heated up in this manner it will be changed-over in the same way as described for the heat store 110′, the valve 124 which allows the combustible gas to pass being closed by the control device or in the case where it is an automatic valve due to its own weight and on account of the excess pressure which is formed in the storage chamber. The heating up of the compressed air supplied through the branch 120 thus begins which air, however, in the heat store 110 is heated to a much higher degree than in the heat store 110′, for example, up to about 1100° C.

The heating of the combustible gases which are supplied through the conduit 111 to the heat store 110 takes place in the heat-exchanger 105 which is heated by a part of the exhaust air heated to for example about 650° C. For this purpose the combustible gas is supplied, at a pressure slightly above atmosphere which may be produced by a fan (not shown), through conduit 127 to the heat-exchanger 105 which consists of a large number of parallel cells into which the combustible gas enters at the bottom. In this the combustible gas flows upwardly in the cells and leaves the latter through the conduit 128 and passes into the annular conduit 129 to which the branch conduits 111 leading to the stores 110 are connected.

The numerous cells of the heat-exchanger 105 are contacted on the exterior by the vertical downwardly directed stream of the hot exhaust air which in complete counter-flow to the rising combustible gas, gives up its heat to the latter and leaves the lower end of the heat-exchanger 105 in a cooled down condition.

In this way that part of the exhaust air which gives up its heat to the surface heat-exchanger 105 is cooled down just as much as that part of the exhaust air which is led through the heat stores 110 and 110′ and then passes into the annular chamber 119. The cooling down of the two fractions of the exhaust air to the same temperature can be effected by controlling the amount of the exhaust air led through the heat-exchanger 105 by means of the throttle flap valve 130 operated by hand or thermostatically. With thermostatic control the arrangement is such that the adjustment of the throttle valve 130 is responsive to the temperatures in the exhaust air conduit 131 and in the annular conduit 119.

The entire heat storage system is operated so that one or other part of the heat stores 110 and 110′ is always being heated whilst the rest of the heat stores gives up its heat to the compressed air to be heated. After the change-over, the previously heated heat store gives up its heat to the compressed air whilst the heat stores previously cooled by the compressed air are heated up. In this way the heat exchanger 105 in which the combustible gas is pre-heated always operates in the same way. With this type of operation the compressed air in the heat stores 110 will be heated very much higher, for example to 1100° C

than in the heat stores 110' in which the air is heated to a less degree, for example only to 600° to 650° C. If for heating the compressed air to the higher temperature double as much heat storage 110 is provided as heat storage 110' for lower temperatures the different amounts of compressed air at the high and lower temperatures will be mixed in the annular conduit 123 and will then flow with an average temperature, of for example 950° C, through the conduit 102 upwardly to the hot air engine.

This heating up of the compressed air to different values is effected so as to produce a particularly advantageous output control of the hot air engine. If the output of the hot air engine is to be reduced the amount of the air sucked in by the air compressor can be throttled in known manner. In this way the weight of the air compressed thereby as well as the pressure of compression is reduced. Instead of throttling the air sucked in by the air compressor the speed of rotation of the air compressor can also be reduced in also known manner which also causes the weight of air and the compression pressure to fall. Further, in each of the two above cases the amount of the combustible gas which is supplied to the heat-exchanger 105 may be reduced, for example by throttling the amount of gas sucked in by the fan which conveys the combustible gas. Nevertheless the weight of the combustible gas should not be reduced in the same ratio as the weight of the circulated compressed air, but to a somewhat greater extent if, as is desirable, the same exhaust air temperature in the conduit 103 should be produced as on full load, since due to the smaller compressed air pressure the expansion ratio for the hot air engine has been reduced.

Corresponding to the smaller expansion ratio and the smaller supply of fuel, the air temperature in the conduit 102 leading to the power engine should be lowered. This is effected by causing not all the heat stores 110 and 110' to be traversed in the same ratio with smaller amounts of air and gas but primarily those amounts of heat delivering exhaust air and heat absorbing compressed air will be reduced which are conveyed through the heat stores 110 having combustion chambers and further to about the same degree as the amount of reduction of the combustible gas. In this way the temperature to which the heat storage material of the heat stores 110 is heated up remains substantially the same, that is, for example 1100° C.

Further, after the change-over an amount of compressed air proportioned according to the smaller amount of the heating-up gas will be led through this heat-exchanger. In this way the amount of compressed air which is heated to the higer temperature of, for example 1100° C is much smaller in proportion to the amount of compressed air heated to a less degree in the heat store 110' than at full load. This results in a correspondingly lower mixture temperature being produced for the compressed air supplied through the conduit 102 to the hot air engine.

The purpose of this control is to maintain the temperature conditions of the heat storage material of the heat store at the same value even at partial load as at full load, although the compressed air passing to the hot air engine has a lower temperature. This is of great importance in order to allow a hot air engine which has operated for a long time at partial load to be brought rapidly again to full load. If the temperature conditions of the heat storage mass were to vary with the load, a certain period would always elapse before the heat storage material had adapted itself to the new conditions. This would not only cause a delay in the output regulation, but also with the reduction of the output above all compressed air of lower pressure than at full load, but still with the same temperature as at full load, would pass into the hot air engine. Those engine members which would come in contact with expanded air of higher temperature would thus be exposed to harmful influences.

The above-described regulation may be effected with each heat store by a device which is illustrated in Fig. 13. For moving the controlling slide valves 116 there is provided a power cylinder 132 having a piston 133. The two ends of the cylinder 132 are connected by conduits 134 and 135 with a control chamber 136 in which is located a control slide valve 139 which is pressed upwardly by a spring 137 against the end of a lever 138. The other end of the double-armed lever 138 bears through a roller 140 against a cam 141 which is slowly rotated by a driving member, for once per minute. The cams 141 for all the nine heat stores are arranged in succession on a common shaft and the nine respective control valves 139 are contained in a common control chamber 136. The cams are relatively displaced in the direction of rotation so that the heat stores are changed over in succession at the same intervals.

The rotation of the shaft on which the cams are mounted may be effected by an electric driving motor 142 which also drives a pressure oil pump 143 with which it is preferably directly coupled. For driving the cams there are inserted between the shaft of the motor 142 and the shaft of the cams 141, for example two worm drives 144 and 145. The pressure oil pump circulates the regulating pressure oil from the chamber 145 which is not under pressure into the air chamber 147 which in turn is connected with the annular chamber 148 with the control slide valve 139 and through a safety valve 149 with the chamber 146.

By the action of the rotating cams 141 and the springs 137 the control slide valve 139 is brought by means of the lever 138 during each half-rotation of the cam 141 alternately into the upper and lower positions. Thus the oil stream passing through the conduits 134 and 135 is changed over each time, and thus causes the piston 133 and therewith the slide valve 116 to be moved upwardly or downwardly and to remain in the final position until the next changeover is effected.

The final position of the piston 133 and of the slide valve 116 is, however, in the stores 110 having the combustion chamber not always the same, but is determined by a control wedge 150 against which abutments 152 and 153 rigidly connected with the valve rod 151 bear. These abutments are adjustable on the valve rod 151 as regards their position.

The position of the adjusting wedge 150 displaceable in the horizontal direction is determined firstly by an adjustable spring 154 and secondly by a piston 155 loaded by the compressed working medium. At full load of the hot air engine the compressed working medium as already abovementioned is at maximum pressure and thus moves the piston 155 and therewith the regulating wedge 150 completely to the left. Thus the piston 133 and the slide valve 116 can make

their maximum stroke and, therefore, the slide valve 116 wholly uncovers the openings controlled by it for the cooled exhaust air and the compressed air to be heated.

When at partial load the pressure of the working air diminishes, the piston 155 and the control wedge 150 are pressed further to the right so that the stroke of the piston 133 and of the slide valves 116 becomes smaller since the abutments 152 and 153 bear against the control wedge 150. The more the pressure of the working air decreases with reduced output of the hot air machine the more will the controlling wedge 150 be displaced to the right and in consequence the smaller will be the stroke of the slide valve 116 and the smaller the size of the openings uncovered by the same.

The heat stores 110′ without combustion chambers are not provided with this device for controlling the stroke of the slide valve 116. In these heat stores 110′ the stroke of the slide valve is always a maximum.

The valve 108 which should be opened only when the slide valve is in its upper position may be moved automatically or during the last part of the stroke of the slide valve 116 by the latter or may be carried along by the hollow slide valve rod 151 which is closed at the bottom as shown in Fig. 13. In order that the heat stores 110 shall maintain the same operating temperatures also with smaller loads thermostats 165 are provided (Fig. 11) which are located in the hottest parts of the heat stores 110 and which act on controlling members 164 by which the supply of combustible gas is adjusted so that the temperature of the heat store at the location of the thermostats and thus also at other points remains the same with all loads.

In order to ensure the ready operation of the heat storage system operating at high temperatures certain other devices are provided.

The valve 122 which is exposed in the heat stores 110 to the highest temperatures together with the valve itself is provided with water cooling. The supply of water to the valve and the withdrawal of the water from the same may be effected in known manner through the hollow valve spindle. It is preferable in this case to connect the supply and withdrawal pipes in a flexible manner which may be effected by constructing the pipe surrounding the upper connecting head of the valve spindle 122 in the form of a spiral. Flexible metal hoses may also be used for the supply and withdrawal of the water.

Since the hot air engine arranged above the heat storage system is to be supported by itself, for example above its horizontal shaft compensating members are provided both in the pipe 102 for the supply of hot working air and in the pipe 103 for the withdrawal of the exhaust air, which in known manner may be fitted with piston packing or with flexible corrugated tubes. It is also advisable on account of the high temperatures to provide these compensating members with water cooling.

Whilst in the exhaust air pipe 103 it is sufficient to construct the compensating member 156 in this manner with the compensating member 157 of the pipe 102 a special balancing device must be provided on account of the high pressure which exists in this pipe and which may amount to for example 7 or 8 atm. abs. This consists of draw rods 158 which engage the upper part of the compensating member 157 and are connected at their lower ends with a compressed air cylinder 159. The latter is closed at its upper end by a piston 160 which presses against the casing around the annular pipe 123. The compressed air cylinder 159 is connected with a space which is filled with compressed working air, for example through a conduit 161 with the interior of the pipe 102.

In the exhaust air conduits 107 leading to the heat stores slide valves 162 are provided and in the exhaust air conduits 118 through which the cooled exhaust air passes into the annular space 119 slide valves 163 are arranged. Moreover, care must be taken that the conduits 111 for the combustible gas can be shut off by hand, for example by means of valves 164 controlled during operation by thermostats. In this way during operation each of the heat stores 110 together with its respective control members can be removed and replaced by a reserve heat store. During this time of exchange normal operation will be maintained by the remaining heat stores.

In those cases where a gaseous fuel difficult to ignite is utilised, it is advisable as shown in Fig. 15 to cause the same to flow, before mixing with the combustion air in the space 109, firstly to the annular space 125 then through the channels 170 into an annular space 171 enclosed by highly heated walls, where its temperature will be further incresaed. With this higher temperature the gaseous fuel then flows through the channels 126 which are circumferentially displaced relatively to the channels 170 into the chamber 109 where it is mixed with combustion air.

Instead of the heat stores 110 and 110′ being arranged around the exhaust air conduit 103 in the form of a circular ring, the rim if desirable in view of space conditions may also be non-circular for example the same may be oval.

The invention can be applied to all kinds of power engines, for example reciprocating engines or turbines.

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PUBLISHED
APRIL 27, 1943.
BY A. P. C.

M. MARTINKA
POWER ENGINE PLANT
Filed Feb. 21, 1939

Serial No.
257,613
5 Sheets-Sheet 1

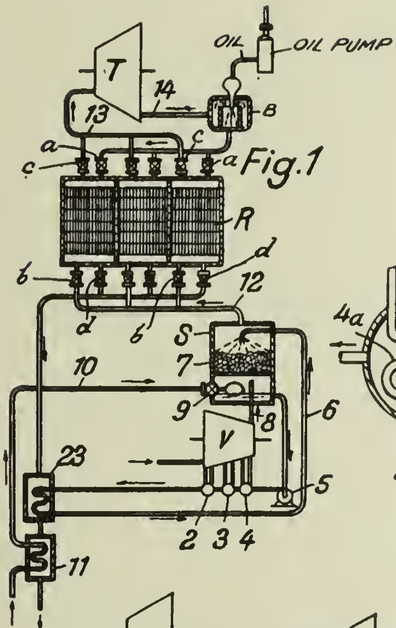

Fig.1

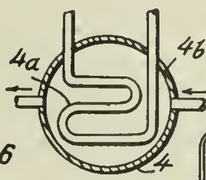

Fig.1a

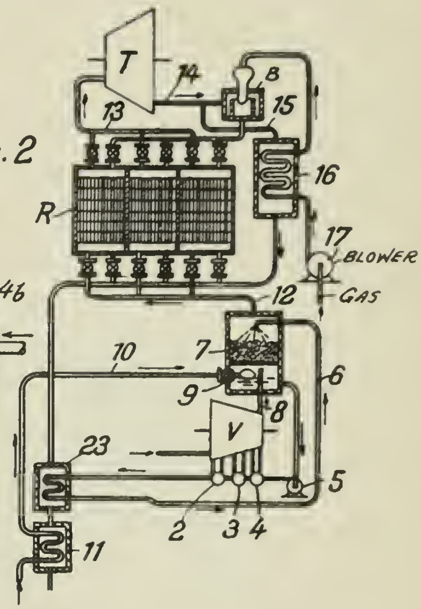

Fig.2

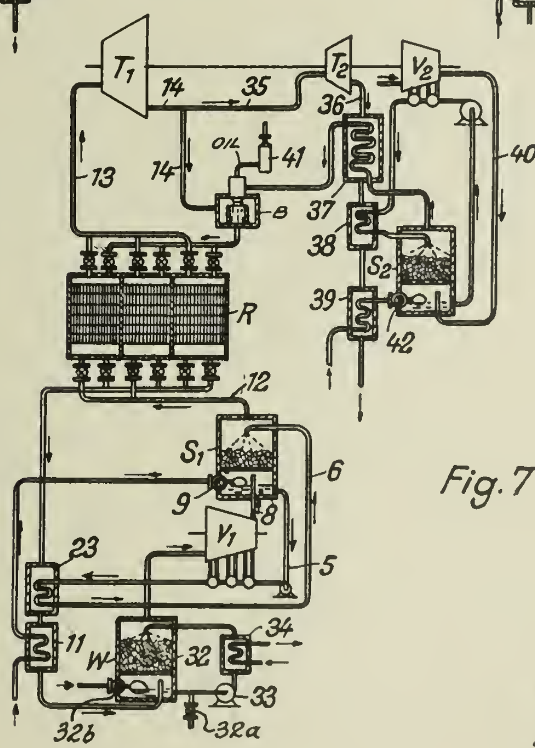

Fig.7

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PUBLISHED
APRIL 27, 1943.
BY A. P. C.

M. MARTINKA
POWER ENGINE PLANT
Filed Feb. 21, 1939

Serial No.
257,613
5 Sheets-Sheet 2

Fig. 4

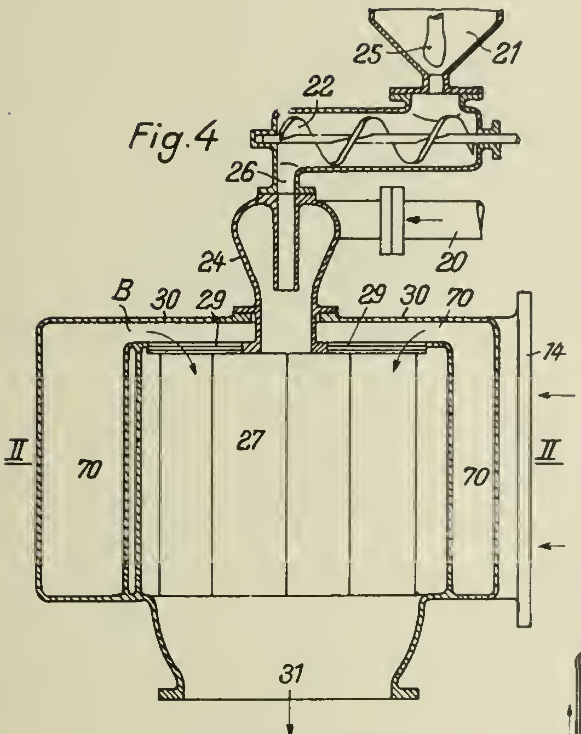


Fig. 3

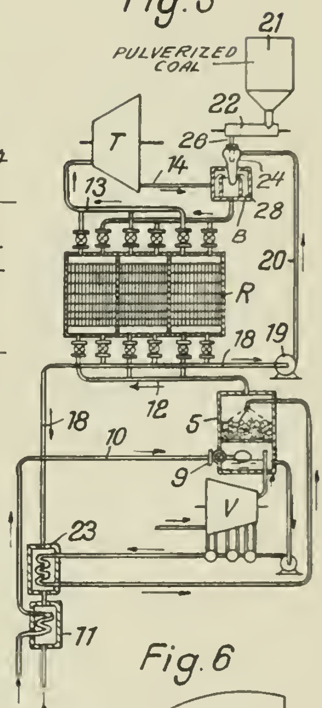


Fig. 5

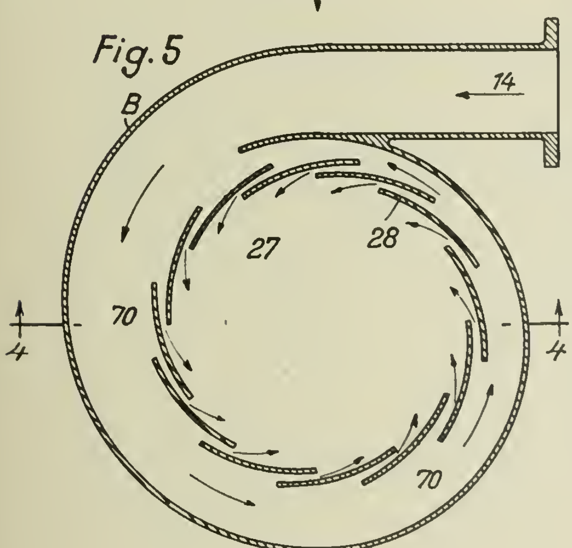
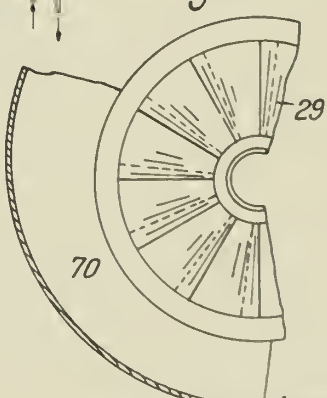


Fig. 6



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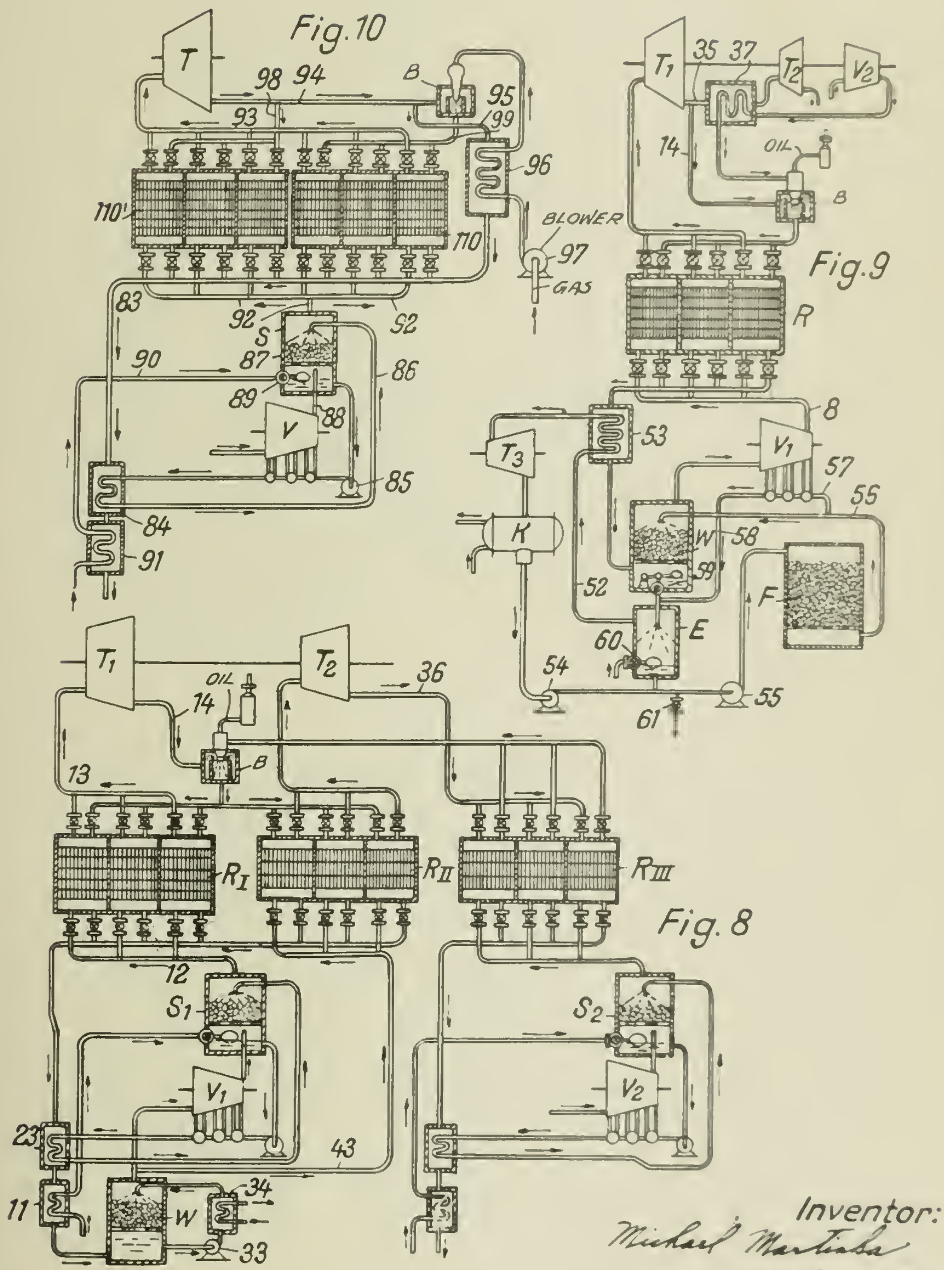
PUBLISHED
APRIL 27, 1943.
BY A. P. C.

M. MARTINKA
POWER ENGINE PLANT
Filed Feb. 21, 1939

Serial No.
257,613
5 Sheets-Sheet 3



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PUBLISHED
APRIL 27, 1943.
BY A. P. C.

M. MARTINKA
POWER ENGINE PLANT
Filed Feb. 21, 1939

Serial No.
257,613
5 Sheets-Sheet 4

Fig. 11

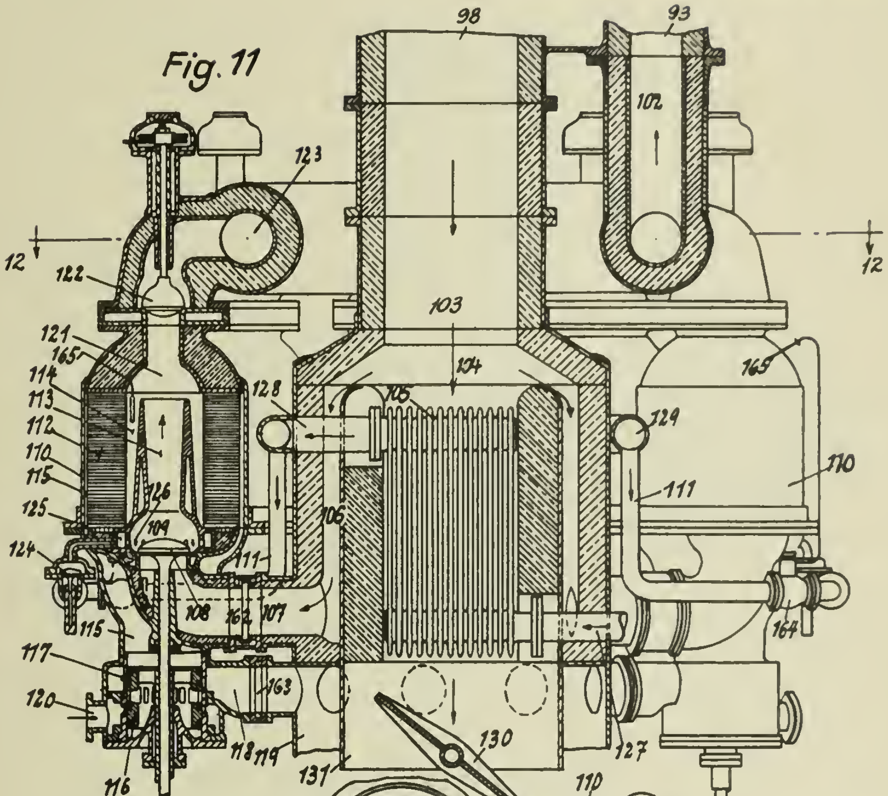
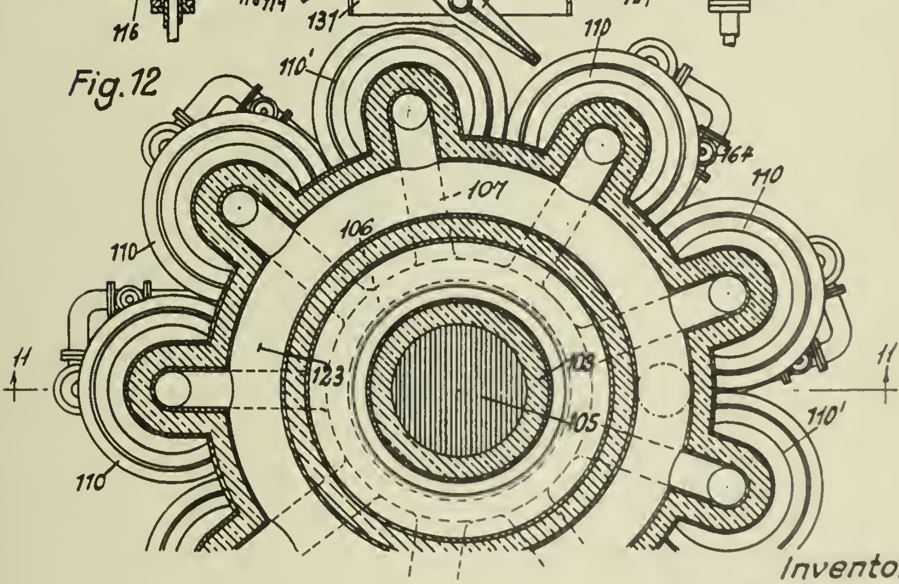


Fig. 12



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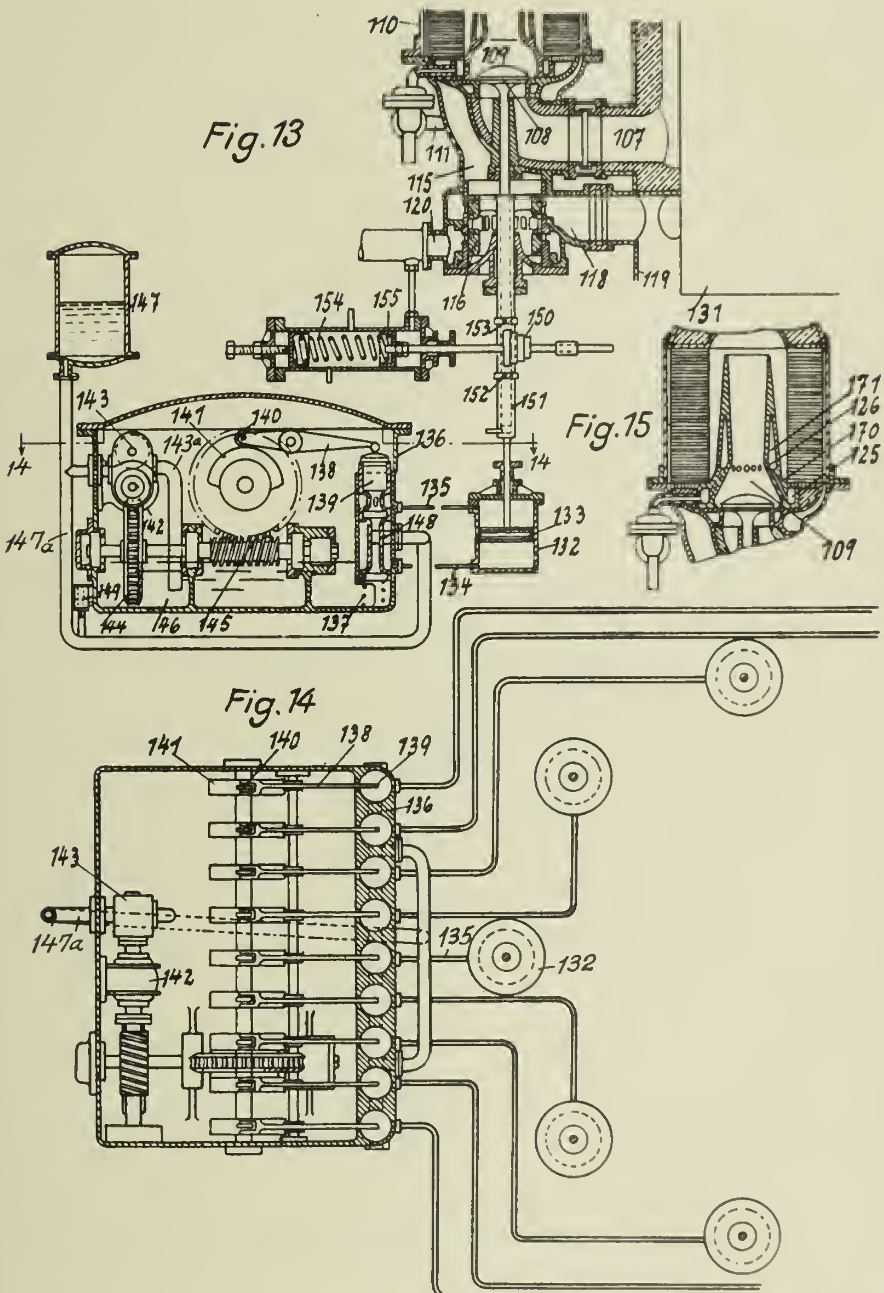
PUBLISHED
APRIL 27, 1943.
BY A. P. C.

M. MARTINKA
POWER ENGINE PLANT
Filed Feb. 21, 1939

Serial No.
257,613
5 Sheets-Sheet 5



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Published Apr. 27, 1943

Serial No. 258,310

ALIEN PROPERTY CUSTODIAN

METHOD FOR THE CUTTING OF THE BEVEL ON HULL PLANKS IN CARVEL BUILT VESSELS

Bjarne Aas, Fredrikstad, Norway; vested in the Alien Property Custodian

Application filed February 24, 1939

The usual method of cutting the bevel on hull planks in carvelbuilt vessels is to first mark the bevel angles on a board and then by means of a gauge controle the different bevel angles along the planks as they are cut, the planks being clamped down to a bench in a vertical position.

The method according to the present invention is characterised therein that the planks when the bevel is to be formed by planing or other working method is clamped to a table or the like at an angle relatively to the same corresponding to the bevel angle of the plank at every point along the length of the plank, so as to allow the continuous bevel form to be obtained by means of a tool, the cutting edge or edges of which is or are perpendicular to the said table. If a tool is used the edge or edges of which is or are at another angle to the table, this must be considered at the determination of the angle at which the plank is to be clamped to the table or support. Conveniently the plank is clamped on wooden blocks or in clips spaced at suitable intervals along the table, for instance in accordance with the frame spacing of the vessel, the blocks or clips being so adjusted that the plank when clamped, is situated at angles to the table corresponding to the bevel angle at each individual point.

In order to enable the tool to be passed continuously along the length of the plank during the cutting, the edge of the plank is arranged so as to extend freely outwards from the blocks or clips.

The cutting or planing may be carried out by hand or by means of a planing machine or may, if desired, be carried out by means of a cutter or another suitable tool, and the cutting may be completed in one operation.

The accompanying drawing illustrates schematically some embodiments of arrangements suitable for the carrying out of the method according to the invention.

The figures 1 and 2 illustrate the use of blocks arranged on a table for securing the plank in the desired position relatively to the table. 1 designates the table which is provided with holes 2 in places where it is desired to locate blocks 3. The blocks are secured to the table 1 by means of screws or nails 4. The top surfaces 5 of the blocks 3 are inclined relatively to the table 1 corresponding to the bevel angle to which the plank 6 is to be cut at that particular point. The plank is clamped against the surfaces 5 by means of clamping frames 15 or other suitable means, and a portion 7 of the plank extends freely beyond the blocks 3, whereby the cutting tool may be passed along the whole length of the plank unhindered by the blocks. The portion 9 of the plank which is to be cut away in order to obtain the bevel form is bounded by a line extending perpendicularly from the edge 8 of the plank of the table 1, and may be cut away by means of a tool passed along the table and having its cutting edge perpendicular to the same. The operation may also conveniently be carried out by means of a rotating mechanical tool. As each individual block adjusts the plank at an angle corresponding to the bevel at that particular point of the same, a continuous smooth surface of correct bevel angles along the whole length of the plank is obtained.

As shown in figure 3 the plank 6 may be fastened in clamping frames 10 with screws 11, each clamping frame being pivoted on a support 12 by means of a pin 13, the support being secured to the table 1, for instance by means of screws. The clamping frames 10 then are adjusted so that the plank 6 at each frame is adjusted according to the bevel angle in relation to the table 1, and is then locked in this position for instance by means of a nut 14. The cutting is carried out in the manner described in connection with the figures 1 and 2.

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PUBLISHED

APRIL 27, 1943.

BY A. P. C.

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METHOD FOR THE CUTTING OF THE BEVEL ON HULL PLANKS IN CARVEL BUILT VESSELS
Filed Feb. 24, 1939

Serial No. 258,310

Fig. 1

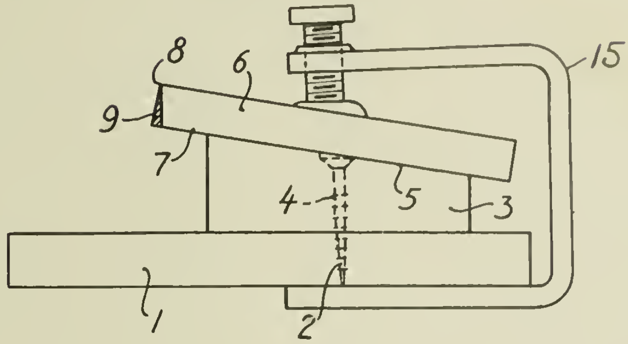


Fig. 2

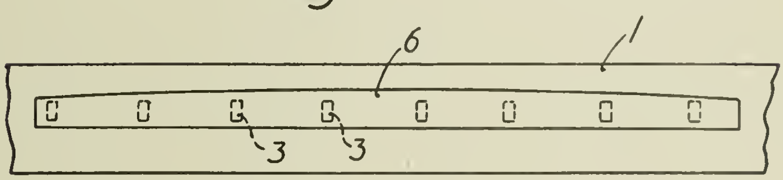
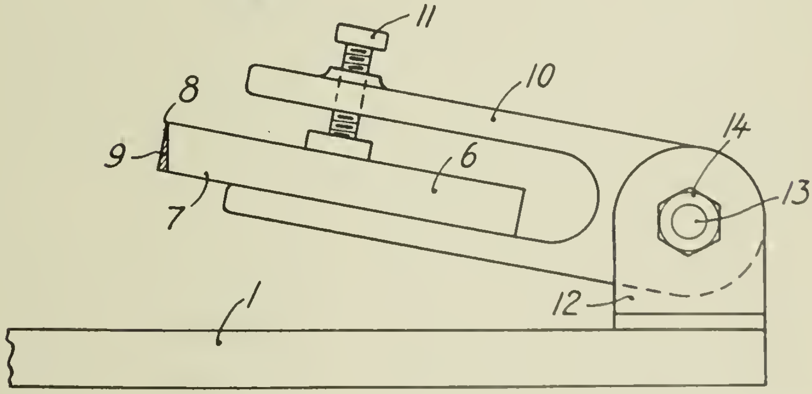


Fig. 3



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Published Apr. 27, 1943

Serial No. 258,329

ALIEN PROPERTY CUSTODIAN

MECHANICAL CLOSING DEVICES FOR INJECTION MOULDING MACHINES

Hans Gastrow, Zerbst in Anhalt, Germany; vested in the Alien Property Custodian

Application filed February 24, 1939

In injection metal or plastic masses, high pressures, which may amount particularly in the case of plastic masses to over 1,000 atmospheres, occur within the mould. Consequently, when the injecting parts are of large superficial area, the mould, which generally is in two parts, is opened by forces which may amount to 100 tons or more. These forces must be taken up by the locking means, and the expansion of this locking means must be kept within very narrow limits.

A mould closing device has two carriers, one for each half of the mould. Normally these slide tables for the moulds, so far as they are mechanically driven, are opened, closed and locked by eccentrics, toggle levers or double toggle levers. For the purpose of locking, the movable slide table of the mould is pressed against the fixed slide table of the mould by the toggle lever. The toggle lever bears against the frame of the injecting moulding machine or against the rails or tie rods, which are connected with the fixed slide table of the mould or have an abutment for the latter respectively. Due to the great length of the hitherto usual locking means, the mould cannot be closed safely even by employing great locking forces, as in consequence of the great forces within the mould due to the injection procedure, the deformations of the locking pieces reach values which cause an undesirable separation of the halves of the mould from each other.

In accordance with the invention, the locking of the slide tables of the mould is effected by mechanically driven means in such a way that the locking forces which act against the forces for opening the mould are directly transmitted from one slide table of the mould to the other. This arrangement enables the locking means to be kept short, with the result that expansion of the locking means is reduced to a negligible amount.

Screw bolts and nuts are employed, in accordance with the present invention, as locking means, by means of which pressure is brought to bear upon both the slide tables of the mould. The drive engages the nuts. An electric driving motor is directly attached to the movable slide table of the mould, in accordance with the present invention. This motor serves both for closing and opening the closing device of the mould. The mounting of the motor upon one of the slide tables of the mould has the advantage that the necessary force for the locking members may be transmitted in the shortest way to the said nuts. Moreover a shortening in the length of the construction of the machine is thereby achieved.

The invention will now be described with reference to the accompanying drawings, showing by way of example one embodiment:

In the drawings:

Figure 1 is a section through the locking device of the mould on the line 1—1 of Figure 2,

Figure 2 is a section on the line 2—2 of Figure 1,

Figure 3 shows a horizontal section on the line 3—3 of Figure 2 and

Figure 4 shows a further embodiment of the invention given as an example.

As shown, only the two guide rails 1 of the casting machine are represented and also the machine bed 2 which serves as a guide surface for both the slide tables 3 and 4 of the moulds. Also, a part 5 of the bed 2 is illustrated in Figure 1, which will be referred to later. The driving motor 6 of the closing device of the moulds is directly flanged on to the casting housing 7, which again is screwed to the movable slide table 3 of the moulds. The motor shaft is connected within the cast casing 7 through a friction coupling 8 with a toothed wheel 9 mounted in the housing 7. The toothed wheel 9 engages the toothed wheel 10. This toothed wheel 10 is fixed on to the hollow shaft 11 mounted in the axis of the closing device of the moulds. A toothed wheel 12 is mounted on this hollow shaft. Moreover the cast body 13 is rotatably mounted on this hollow shaft by a ball bearing (not shown). This cast body carries two axle pieces 14. Rotatably mounted upon the axle pieces 14 are double toothed wheels 15 with two toothed rims 16 and 17 differing in diameter and number of teeth. The toothed rim 16 is engaged on the one hand with the toothed wheel 12 and on the other hand with a toothed rim 18 which is secured in the interior of the pot shaped wheel 19. This wheel is rotatably mounted upon the shaft 11 between the toothed wheels 10 and 12. It possesses besides the toothing 18 bevel teeth 20 which engage with a correspondingly toothed bevel wheel 21. This bevel wheel is attached to the axle 22, which is rotatably mounted in the movable slide table of the mould. Upon the free extremity of the axle 22 is keyed a crank 23 which forms, together with the rod 24, a crank gear. The rod 24 is pivotally connected with the bolt 25 which is fixedly inserted in the engine bed 5.

The teeth 17 of the double toothed wheels 15 are engaged with an internally toothed wheel 26, which latter is rotatably mounted partly in a flange of the movable slide table 3 of the mould and partly on the periphery of the toothed wheel 19. The toothed wheel 26 has a smaller diameter than the toothed rim 18. Accordingly the number of the teeth is also smaller.

The toothed wheel 26 is provided further with external teeth 27, which engage four externally toothed nuts 28 rotatably mounted in the movable slide table 3. The nuts 28 bear against the slide of the moulds through the ball bearing 29. The nuts 28 in association with the screw bolts 30 serve to lock the mould. The screw bolts are adjustably fixed in the slide table 4 of the mould,

they are provided each at their front end with a thread 31 which can be brought into engagement with a corresponding internal thread 32 of the nuts 28. The bolts 30 are flattened over the entire length of the thread 31. The internal thread 32 of the nuts 28 has corresponding cut away portions. These cut away portions enable, when the nuts 28 are in appropriate angular position, the screw bolts 30 with their threads 31 to be inserted in the nuts, in order to bring about later the engagement of the threads 31 and 32 upon corresponding rotation of the nuts.

The operation of the device is as follows:

If in the case of the open position of the device the motor 6 is switched on, the toothed wheels 9 and 10, the toothed wheel 12 and in consequence also the double toothed wheels 15 are driven through the adjustable friction coupling 8.

When the mould is open the nuts 28 are prevented from rotating by a catch. For this purpose a cavity 33 is provided on one of the nuts into which cavity a locking bolt 34 extends when the device is in an open position. The bolt 34 can be brought out of engagement by a bell crank lever 35 mounted on a stationary pivot 35*a* if a cam-shaped surface 36 provided on the screw bolt 30 hits against the lever arm 37 of the lever 35 and rotates it in an anti-clockwise direction.

The locking of the nut 28 prevents rotation of the toothed wheel 26. The double toothed wheels 15 then roll upon the toothed wheel 26 and drive simultaneously the wheel 19 and in consequence the bevel wheel 21. By means of the crank gear 23, 24 the slide table of the mould is then moved into the closing position. The half 38 of the mould connected with the slide table 3 of the mould bears against the half 39 of the mould connected with the slide table 4. The slide table 4 is moved against an abutment 40. The nuts 28 are unlocked during this movement. The wheel 26 may now rotate, whilst the wheel 19 is held fast, as the rotation of the crank gear 23, 24 is limited by abutments. The unlocking of the nuts 28 takes place shortly before the termination of the closing movement approximately when the threads 31, 32 of the screw bolts and of the nuts are distanced at a half pitch of the thread from the final engaging position. The closing movement terminates as soon as both threads may engage each other. From now on a rotation of the nuts may take place. The closing movement may be obtained by spindle- or toothed rack and pinion drive instead of by crank gear.

The locking is effected by rotation of the nuts 28 through which the screw bolts are stressed. With increasing stressing the required torque moment of the motor and thereby rate of charge of the motor increases. If the current surpasses a determined value, the motor is then switched off by a relay. It is also possible to adjust the friction coupling 8 in such a way that with a determined torque moment the coupling of the motor with the toothed wheel 4 is released.

When the injecting and cooling process is terminated, the motor is again switched on but in an opposite sense of rotation. In this connection the pressure generated between the threads and the friction produced thereby is so great that the wheel 26 is held fast. The double toothed wheels 15 then again rotate the wheel 19 and thereby the crank gear 23, 24, that is to say both slide tables of the mould are moved first in the opening direction. Upon a short movement in common, the slide table of the moulds 4 abuts against the fixed stop 40. If this stop is taken away the slide table 4 of the mould abuts against a second stop only by travelling a greater distance, in order to remove the mould further from the injecting nozzle before opening. By means of the stop a further rotation of the wheel 19 is prevented. The motor then causes a rotation of the wheel 26 and in consequence a rotation of the nuts 28. For the initial movement of the nuts a sufficient torque moment of the motor 6 is already available at this moment which is still assisted by the momentum of the motor armature of the toothed wheel and other parts.

As soon as the nuts 28 have rotated through an angle of 90°, they are prevented from further rotation by an abutment, that is to say the wheel 26 comes to a standstill. As the locking between both the slide tables of the mould is released, the wheel 19 can continue to rotate and move the half of the mould 3 to the inner position. When this position is reached, the driving motor is switched off by an end contact.

It has been already mentioned that the screw bolts 30 are adjustably fixed in the slide tables 4 of the mould. Nuts 41 serve for this purpose which are screwed upon the ends of the threaded bolts 30. Lock nuts 42 ensure that the adjusted position shall always be maintained. This adjustable fixing enables differences in length of the individual screw bolts to be compensated in order to obtain a uniform tightening of the arrangement by a plurality of locking bolts.

If screw bolts are used as described for locking the halves of the mould, the distance between both halves of the mould 3 and 4 is fixed. In order to allow the balancing of any differences in the thickness of the individual parts of the mould, the half 38 of the mould is fixed upon a wedge-shaped slide table 43, which can be set by a wedge 44 with the aid of a screw 45.

The formation of the shaft 11 as a hollow shaft has the advantage that an ejecting rod 46 may be passed therethrough. Shortly before the open position is reached, this rod abuts against an abutment 47 which is secured to a rim 48 of the housing part 5.

As shown in Figure 4, the motor may be employed simultaneously also for driving an injecting piston 50. This is illustrated diagrammatically in Figure 4 as follows:

The bolts 30*a* are tubular. Through these tubes extend the bars 51, which in turn are connected with the piston 50 through a bridge 52 with the interposition of a spring buffer, and are rigidly connected at their other ends with a cross-head 52, in the centre of which is mounted the spindle 53.

This spindle serves instead of the crank drive 23, 24 for the movement of the rear slide table 3 of the mould and when the heating of the slide table of the mould is finished drives the piston in the injecting cylinder 54 through the intermediary of the tie rod 51.

Finally, the drive from the motor 6 to the casting body 13*a* in which the double toothed wheels 15 are mounted in the case of this embodiment takes place directly from the bevel wheel toothing 55.

In order to be able to regulate the velocity of the closing movement of the rear slide table 3 of the mould, and also the speed of the piston, a countershaft 56 is built in within the drive of the spindle 53 to provide at least two speeds.

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PUBLISHED

APRIL 27, 1943.

BY A. P. C.

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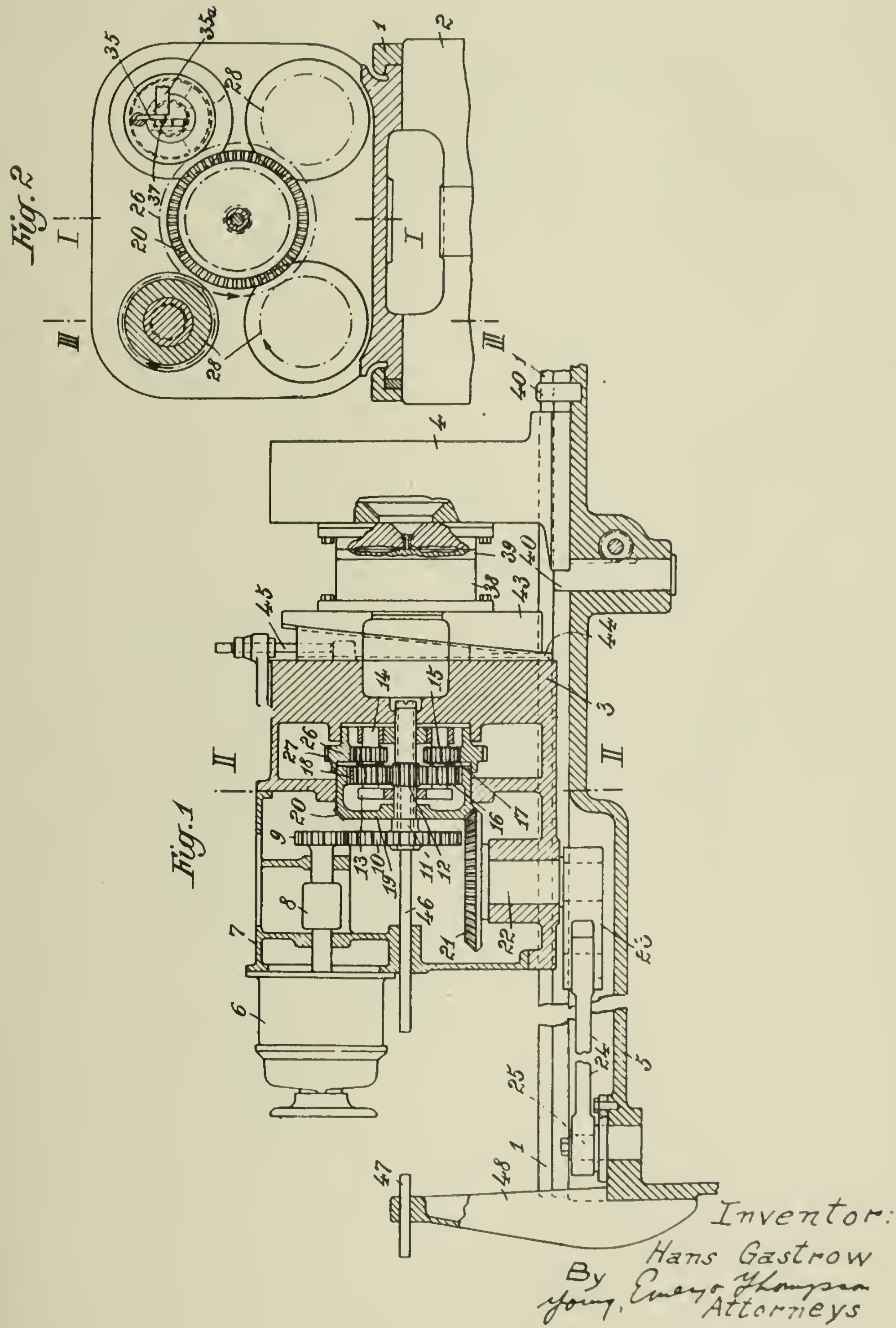
MECHANICAL CLOSING DEVICES FOR
INJECTION MOULDING MACHINES
Filed Feb. 24, 1939

Serial No.
258,329

2 Sheets-Sheet 1



PUBLISHED

APRIL 27, 1943.

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Serial No.
258,329

2 Sheets-Sheet 2

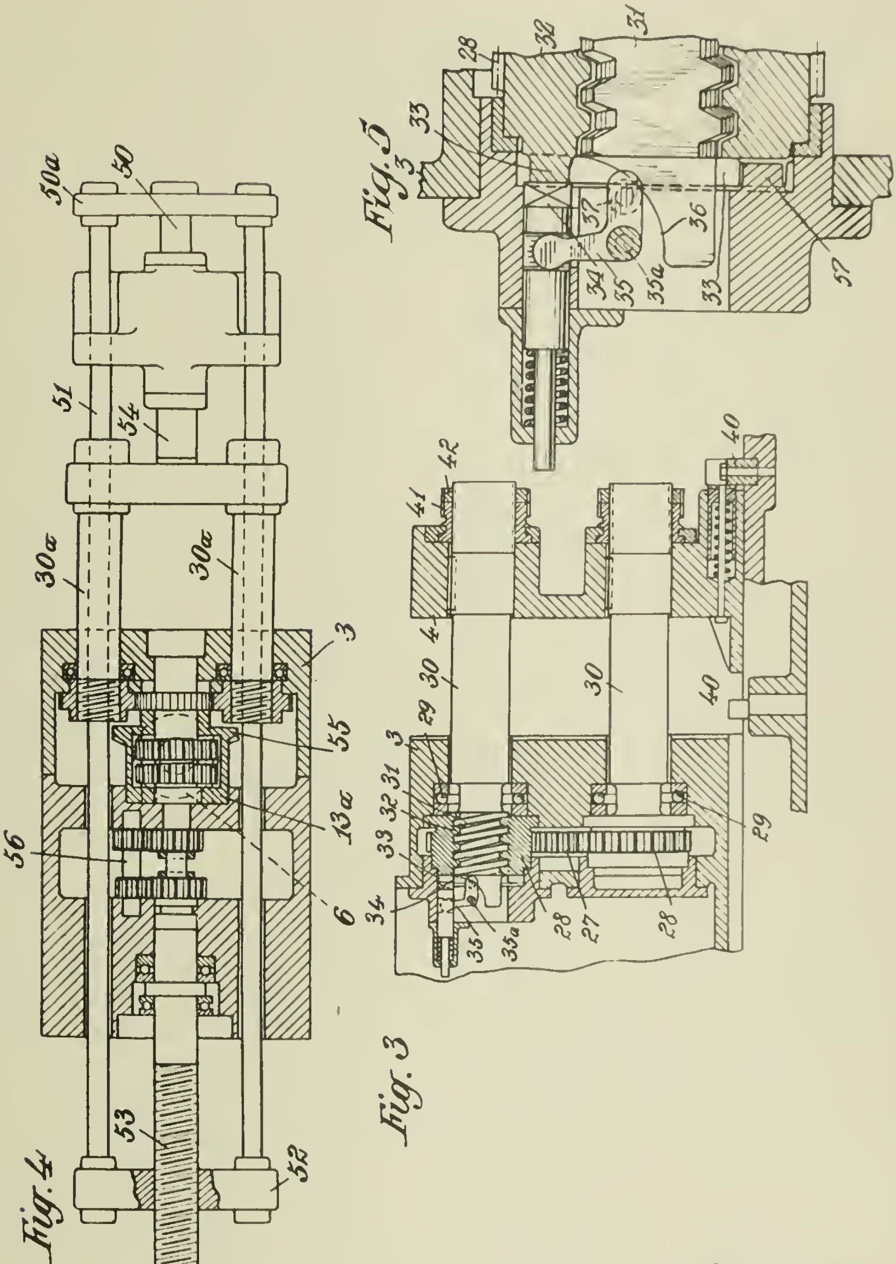

Fig. 4

Fig. 3

Fig. 5

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Published Apr. 27, 1943 Serial No. 259,213

ALIEN PROPERTY CUSTODIAN

ARTIFICIAL ASBESTOS AND PROCESS FOR MAKING SAME

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No Drawing. Application filed March 1, 1939

The present invention relates to a process for the manufacture of artificial asbestos-like material. It consists essentially therein that oxide-silicate foundation masses of approximately the chemical composition of the products to be manufactured but preferably containing an excess of Na_2O (if desired replaced in part by CaO) are heated in the presence of certain products, namely fluorine compounds and water, to temperatures below their melting point. Preferably the operation is carried out in a closed or indirectly heated reaction chamber.

In the case of the constituents which are not volatile under the conditions of the reaction (e. g. MgO) the differences of the composition of the starting products must not differ very much from the analytical result of the corresponding natural asbestos by e.g. 10% or even less when that particular same type of asbestos is to be obtained; if it is only desired to obtain asbestos, no matter of what composition, then it is sufficient that all the constituents of asbestos should be present in the ingredients, the combination being immaterial; Na_2O must always be present. In the case of the constituents which are volatile under the reaction conditions, in the first case if it is desired to obtain an asbestos of a certain composition such an excess must be present that quantities corresponding to those found by analysis in natural asbestos are present at the end of the reaction. In the second case if any asbestos is to be obtained it is sufficient that the constituent concerned is present at the end of the reaction, or an equivalent constituent, e.g. CaO instead of Na_2O, FeO instead of MgO, Al_2O_3 instead of SiO_2 (all may only be partly replaced). Naturally all constituents which are not absolutely necessary for the formation of asbestos can be omitted. SiO, MgO, Na_2O must always be present (the last named as stated must be always present in excess compared with natural asbestos, unless another composition of the synthetic asbestos is considered), otherwise the Na_2O excess must amount from about 2% if the natural asbestos contains Na_2O to approximately 20% (with rising temperature less).

Na_2O may be replaced by CaO up to about 80%
SiO_2 may be replaced by Al_2O_3 up to about 10%
MgO may be replaced by FeO up to about 50%

The quantity of fluorine amounts approximately to 3–40% of the asbestos, the first percentage being preferably in the case of a closed reaction vessel, the latter in the case of an open reaction vessel; in the latter case 20 to 30% is the optimum quantity. The lowest quantity of water amounts to 10% in closed reaction vessels (already introduced by the constituents of the starting mixture) to 1500%, preferably 300 to 500%. The water is preferably introduced into the reaction mixture as steam. With increasing pressure less water is necessary. The water used up by the reaction, e.g. also by escaping water-containing reaction gases is replaced in any suitable form: liquid water, steam, water-containing materials o.th.l.

When working under pressure the temperature can be as low as 250° C. and when working without pressure it can be as low as about 700°. In the former case the best results are obtained at 350°, in the latter case at about 900 to 1000°.

The minimum duration of the reaction has not definite limits, and it is possible for example to obtain a yield already after a quarter of an hour. The maximum duration depends on the reaction conditions e. g. height of the mixture of starting materials and the optimum or the practical completion of the reaction can for example be ascertained simply by the removal of samples and the quantitative analysis thereof with reference to the asbestos formed.

The same principle can be employed for the manufacture of all types of asbestos, thus therefore the non-fluorinated ingredients can be made up from oxides and SiO_2, depending on the analysis of the natural asbestos desired which is to be manufactured. In this connection it should be noted that it is unnecessary to keep accurately within stoichiometric proportions.

The fluorine can be added to the ingredients in my desired suitable manner and that either in the cold or at higher temperatures, for example by

(a) treating them with hydrofluoric acid (gaseous or liquid);

(b) the addition of silicofluorides;

(c) passing in SiF_4 or another volatile silicon-fluorine compound; according to known reactions SiO_2 is thus added simultaneously;

(d) the introduction or passing in of any desired decomposable organic fluorine compounds;

(e) other metal fluorides, acid fluorides, double fluorides e.g. AlF_3, $NaHF_2$ or cryolite;

(f) self-decomposing also non-metal fluorides, the residual portion of which does not pass into the asbestos-fibre or only in part, e.g. platinum fluoride, manganese fluoride, ammonium fluoride;

(g) the addition of elementary fluorine.

The metal oxides of the initial mixture are thus converted wholly or in part primarily before

the finishing burning into the fluorides or silico fluorides, oxyfluorides etc.

It is also possible to replace the oxides wholly or partly by equivalent quantities of other compounds, e.g. by hydroxide, carbonate, bicarbonate, chloride, oxalate, nitrate, fluoride or wholly or partly by equivalent quantities of the metals. This means that such compounds are used which under reaction condition yield the starting materials e.g. $Na_2CO_3 \rightarrow Na_2O$, $NaF \rightarrow Na_2O + HF$, $MgF_2 \rightarrow MgO + 2HF$, $CaF_2 \rightarrow CaO + 2HF$. Silicic acid can be contained in the ingredients in any desired form, that is for example as silica gel, ("active silicic acid") water-glass or kieselguhr. It is further possible to use natural minerals or rock as addition substances, e.g. magnesite, olivine, greenstone or other silicates, sand or clay, and finally artificially manufactured glasses or ceramic masses.

The formation of fibres which takes place during the burning and final ignition is helped by giving the initial mixtures a greater internal surface or providing cleft surfaces. This can be obtained by granulating the dry powdered mixture with water, better with water-glass or with salt solution, by rolling out the moistened mixture into leaflets, by the formation of plates or other kind of distortion. Further a granular formation may be obtained by the addition to the ingredients of sawdust or other combustible carrier materials or also by the addition of granulated solid water-containing silica gel which shrinks during the burning. Another method consists in embedding the components of the mixture made into a paste with water in a voluminous gel by the addition of water-glass solution, the formation of cleft surfaces taking place through the shrinking while drying or during the burning.

The mixture of ingredients thus prepared, the fluorine content of which (as fluoride and/or silico-fluoride) is preferably adjusted to 20 to 35% of its dry weight, is now subjected to ignition, preferably by indirect heating, as for example in a muffle furnace. The ignition temperature for the manufacture of all types of asbestos always lies below the melting point of the reacting mass. The temperature of ignition can be lowered if the duration is correspondingly increased. The water is already advantageously introduced as steam or superheated steam during the warming up, beginning at a temperature of the mass of 150 to 200°C. in such a way that it reaches all parts of the ingredients. The introduction of water vapour is continued with advantage through the entire ignition and after ignition. During the after-ignition at temperatures under 500° acid reagents, such as carbonic acid, hydrochloric acid or other acid vapours can be added to the steam to accelerate the removal of fluorine.

During the heating of the mixture fluorine compounds are set free as sublimates (e.g. aluminium fluoride and iron fluoride), and hydrofluoric acid and silicontetrafluoride escape. These gases or vapours can be recovered in any desired suitable manner, for example by condensation, by adsorption by means of suitable adsorbing agents, by passing into water or substances reacting with them (as for example oxides, carbonates or silicates—such as ground serpentine stone—which can combine with fluorine in this manner) and worked up for the making of a new mixture, or they can be led into the crude mixture of ingredients which still require the addition of fluorine before the final ignition, or by a combination of these regeneration methods.

The reaction atmosphere is preferably kept in a reducing state which can be effected by the addition of hydrogen or by the addition of carbon containing compounds, for example sawdust.

The mixtures may advantageously be guided through the reaction chamber on endless bands, carriages (tunnel furnace) or the like. The synthetic asbestos obtained (raw asbestos) is prepared for the various purposes for which it is required by sorting or classification according to fibre length, by treatment with acids or salt solutions (for the removal of the remaining fluorine and for permuting the bases), as well as by mechanical preparation and granulation. The removal of the fluorine is also possible by treatment with acid and water vapours. (final product).

It is sometimes advisable to ignite for a second time, the fluorine, water and Na_2O content being made up to the original quantity preferably before second ignition. Also new raw material may be added instead.

After the first ignition the fibrous material can be rendered parallel by rolling under tension.

The partial replacement of Na_2O by CaO can be carried out up to about 80%, the CaO being included in the calculation, which is sometimes already present in the natural mixture.

The so obtained intermediate and final products are new. They differ from natural asbestos in that the intermediate products (raw artificial asbestos) show a greater content in Na_2O and fluorine than the natural asbestos and a smaller room weight (weight/volume, therefore taking also in consideration the spaces between the crystals, i.e. the volume of pores) than the natural asbestos. The latter is about 0,2 to 0,6 preferably 0,3 compared with about 2,5 to 3,0 of the natural asbestos. The fluorine content of the obtained raw asbestos is about 3 to 16%, the fluorine content of the natural asbestos being up to 3%. The Na_2O content of the raw asbestos is about 3 to 15%, the Na_2O content of the natural asbestos being as a rule less than 2%. It must be mentioned that the raw asbestos obtained according to the invention is a useful and marketable product.

As to the final artificial asbestos it differs from the natural asbestos in that its room weight is about the same as of the synthetic raw asbestos. The same applies to fluorine and Na_2O content.

The new product always contains SiO_2, MgO and Na_2O; a replacement may take place as lined out above on page 3.

The following examples illustrate how the invention may be carried out in practice, but it is to be understood that the invention is in no way limited to the details given in these examples.

Example 1

4 parts of magnesium oxide, 6 parts of silicic acid (e. g. as kieselguhr), 6 parts of soda, 2 parts of ammonium chloride, and 15 parts of ammonium silico-fluoride are mixed preferably under addition of 1–2 parts of saw dust and granulated with about 10 parts of a 20% waterglass solution. Thereupon the mixture is heated up to temperaures of 900–1000°C. in charges of 10 kg with the introduction of steam for 4 to 5 hours in crucibles, retorts or the like.

Example 2

10 parts of calcium carbonate, 10 parts of soda, 43 parts of silicic acid and 31 parts of magnesium fluoride are mixed (raw material) in crucibles or retorts and heated in the presence of small

quantities of steam, which is for example supplied or developed from the combustion gases of the firing or in any other desired manner until the completion of the reaction, i.e. depending on the proportions of the mixture, generally at least an hour and more up to about 1000°C. but in any case below the melting point.

Example 3

0.8 parts of fluor-spar, 1.3 parts of sodium chloride, 2.0 parts of magnesium oxide and 5.8 parts of silicic acid hydrate are mixed and heated in closed chambers, for example in retorts provided with safety valves, heatable boilers similar to those used for example for lime-sandstone manufacture, or other vessels until the completion of the formation of the asbestos in constant presence of steam to temperatures of about 1000°, but in any case below the melting point of the mixture.

According to this example the water necessary is supplied by the silicic acid hydrate. It can likewise be withdrawn from other compounds, e.g. from water-glass, hydrates or hydroxides. Further the water can be introduced as liquid or vapour into the mass in the reaction chamber before or during the reaction and preferably in small quantities, as it is used up by the reactions, adsorption, diffusion or discharge. An addition of larger quantities of water is undesirable owing to the high pressures which would then occur.

Example 4

The operation is carried out as in example 3, but the mixture contains no silicic acid hydrate. Finely ground chalcedon or kieselguhr is added to the mixture instead. In open apparatus a portion of the silicon escapes as SiF_4, SiO_2 equivalent of which is added in excess to balance the loss. The amount of this excess depends on the size of the apparatus used and on the method of working particularly on the speed of warming up. The equilibrium $SiO_2+4HF \rightleftarrows SiF_4+2H_2O$ is first pushed very much towards the left at about 400°C. so that at slow speeds of heating, as when using large apparatus, more SiF_4 is evolved. The optimum SiO_2 excess must therefore be determined by experiment at any time for the given conditions. For charges of 10 kg and a heating up within two hours it is about ¼ of the stoichiometrically necessary quantity of SiO_2.

Example 5

The operation is carried out as in example 1. but an equivalent quantity of magnesite is used instead of the magnesium oxide.

Example 6

10 parts of ground serpentine are mixed with 5 parts of sodium silico-fluoride, and 3 parts of sodium chloride, and granulated with water-glass solution. (In the case of furnaces with ceramic linings hydrogen or illuminating gas is added during the reaction or the same effect is obtained more simply by the addition of carbon-containing substances, as for example about 2 parts by weight of sawdust). The mixture is heated in charges of about 10 kg for about 4 to 5 hours in retorts or crucibles or the like to 900–1000°C.

Example 7

10 parts of serpentine are melted with 14 parts of soda. The glass which contains the necessary MgO and SiO_2 but an excess of sodium oxide is treated with a fluorine-containing mixture, for example with a mixture of 10 parts of magnesium silico-fluoride, 5 parts of magnesium chloride and 6 parts of kieselguhr which have been gelatinised with water-glass solution. The mixture is heated in charges of 10 kg for about 4 to 5 hours in retorts, crucibles or the like to 900 to 1000°C.

Example 8

The operation is carried out as in Example 7, but soda is used in part in place of the water-glass.

Example 9

100 parts of a 20% water-glass solution (from 20 parts of a Na_2O water-glass of 37° Be. and 80 parts of water) are coagulated at about 20°C. by the addition of 5 parts of magnesium silicofluoride with constant kneading. The gel which is pasty at the beginning is allowed to age (for example 24 hours at room temperature), and it is pulverised and intimately mixed (preferably by rolling) with the remaining constituents of the mixture, e.g. with a dry quantity of 12 parts of magnesium fluoride, 8 parts of SiO_2 (in the form of guhr or quartz) and 4 parts of sodium chloride. The ignition is carried out as usual. The finishing ignition temperature for this mixture lies at about 1000°.

By varying the quantity of gel, i.e. by increasing or diminishing its amount relative to the quantity of powder, it is perfectly possible to control the porous volume which is caused by the shrinking of the gel.

Example 10

5 parts of ground serpentine, 3 parts of sodium silico-fluoride and 1 part of sawdust give with 6 parts of water and 1.5 of crude hydrochloric acid a sludge which when stirred with 10 parts of a 20% water-glass solution forms a gel-like paste. After 48 hours ageing at 50 to 60 C. the finishing ignition may be carried out.

The serpentine can be replaced wholly or in part by kindred magnesium silicates, particularly by talc.

Example 11

10 parts by weight of short fibred asbestos or asbestos mixtures, obtained from the first ignition are worked up in a hollander with water to half-stuff. To this are added 2 to 4 parts by weight of sodium silico-fluoride (calculated on the quantity of asbestos) and 1 part by weight of sodium chloride (or a quantity of HCl equivalent as regards the chorine); potato flour or dextrin is also added and to simplify the formation of the paper felt about 1 to 3% of textile waste or cellulose.

After working up on a cylinder machine to asbestos paste which is made denser by compression the recrystallising process takes place, for example in a muffle furnace by ignition at 700 to 1000°C, with the introduction of steam in a reducing atmosphere.

The product of the ignition is washed with water or more suitably boiled in autoclaves at about 150 to 200°C. with dilute acids (e.g. 1/100N HCl) or diluted magnesium chloride solution (e.g. 3%); preferably a solution of iron or aluminiumchloride (5%) is used.

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Published Apr. 27, 1943

Serial No. 260,412

ALIEN PROPERTY CUSTODIAN

DEVICES FOR EXTRACTING COFFEE AND/OR TEA

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Application filed March 7, 1939

The invention relates to improvements in devices for extracting coffee and/or tea, comprising a container for the supply of extraction water and a strainer on which the coffee or tea to be extracted is supported in such a manner as to keep the said substances separated from the said supply of water before extraction occurs.

According to the invention the device for extracting coffee and/or tea comprises means enabling the extraction water to be brought to boiling by the heat of steam.

The advantage offered by the invention consists in the fact that the container for the supply of extraction water in case it is made of glass need not be made of fire-proof glass which is expensive, and the shaping and working of which is difficult, but may be made of ordinary kinds of glass such as may be manufactured in any glass factory. A further advantage results from the fact that heating by means of steam will cause the water in the water container and intended to be used for extracting coffee and/or tea to be heated in a gradual manner and under the most favourable conditions.

According to a particular embodiment of the invention, the device for extracting coffee and/or tea comprises means adapted for the direct introduction of steam into the interior of the container for the said supply of extraction water, this being done preferably in such a manner that the said means issue into the said container above or, preferably, below the level of the supply of extraction water. It results therefrom the advantage that the coffee or tea decoction obtained will not suffer a disadvantageous change of flavour, i. e. will not assume a so-called metallic flavour even in case the generation of steam is effected electrically by means of members placed directly into the water. Another advantage consists in that heating the extracting water by means of steam introduced directly into said water will improve the quality of the ordinary water used for extracting, owing to the fact that the said steam, becoming recondensed in the extracting water, is converted into distilled water.

The invention will be explained in greater detail with reference to the various embodiments shown by way of example on the drawings.

Figs. 1, 2, 3, and 4 are side elevations, partly in section, each showing one embodiment of the invention. Fig. 5 is a view from below of a strainer to be inserted into the device, and Fig. 6 is a section belonging to Fig. 6. Figs. 7 and 8 are side elevations, partly in section, each showing a further embodiment of the invention; Fig. 9 is a side elevation belonging to Fig. 8, Fig. 10 shows a combination in connection with Figs. 8 and 9, and Fig. 11 is the vertical section of a variant.

On all of said figures corresponding parts are denoted by identical letters of reference.

On Fig. 1 *a* denotes the container where extraction takes place, and *b* is the container to be filled partly with the supply of extraction water; container *b* is arranged below the extraction container *a* and into the water space of container *b* a rising pipe *d* is descending at the top of which is inserted a strainer *f* shown more detailed in Figs. 2, 5 and 6. The said strainer is preferably made of a pressed glass disc into the periphery of which serrations f_1 are pressed which are of such depth that whilst the water is able to flow through them from the container *b* into the container *a* and vice-versa, the said serrations nevertheless produce the desired strainer effect as against the particles of tea and coffee. By making the disc *f* from such pressed glass instead of polished glass manufacture is rendered substantially easier and less expensive.

According to Fig. 1, a steam generating container *g* is provided below the water container *b*. The steam generated in the container *g* is passing through the steam discharge pipe constituted by three parts h_1, h_2, h_3 assembled to a single pipe line as shown, and the steam is introduced into the container *b* above the level of the water contained in the latter.

We prefer to place the three containers *a*, *b* and *g* loosely above each other and to press them mutually against each other by a yoke *k* made of metal and shaped so as to serve as a handle, the containers being fixed and held together by means of a screw k_1 inserted in the top of said yoke *k* and pressing against the cover a_2 of said upper container *a*, the said cover being preferably made of metal. This will enable the decoction after its preparation has been completed to be poured out from the container *b* through the pipe branch or spout b_1 without having to dismantle the apparatus, which dismantling (apart from the complication of handling) might be disadvantageous owing to the fact that the substances imparting its aroma to the decoction might be lost by volatilizing away.

All three containers *a*, *b*, *g* are preferably made of glass but it is advantageous to apply on the top of the steam generating container *g* and the water container *b* a metal border g_1 and b_2, respectively. The steam generating container *g*

as shown in Fig. 1 is adapted for being heated electrically for which purpose we prefer to employ an electric heating system comprising electrodes j, into which the current is led through terminals j_1.

During the preparation of the decoction, the spout pipe b_1 provided on the bordering metal ring g_2 is closed by a stopper. The containers b and g are preferably made open on their top and they are closed merely by assembling the device through the container to be situated above them. Between two containers to be assembled in the manner shown we prefer to interpose a packing ring i.

The parts h_1 and h_3 of the steam discharge pipe h_1, h_2, h_3 are preferably made of metal. The said pipe branches h_1 and h_3 may be soldered to the bordering metal rings g_2 and b_2, respectively, and are connected by means of a small rubber pipe h_2 drawn on them.

The device has to be handled and operates in the following manner:

The steam-generating container g is filled with water to about one-half, and the container b is filled with water to about three-quarters of its total volume. Following this the containers a, b and g are placed on each other and united by means of the yoke k so as it is shown in Fig. 1. Thereupon, heating is started which can be done by means of electric current as mentioned. The steam generated in the container g passes through the pipe h_1, h_2, h_3 into the middle water tank b in which the cold water will at first absorb the steam streaming in. As soon as the water has already become heated in the central container b, the steam pressure produced will force the water through the rising pipe d upwards into the extraction container a and through the layer of tea or ground coffee which has been placed already previously on the strainer f. The steam will now be absorbed by the water until latter reaches a temperature of about 100° C. As soon as the said temperature has been reached the excess steam will blow out through the pipe or valve a_1 which is mounted on the top of the extraction container a and is adapted, in a manner known per se, to indicate the discharge of the steam acoustically in the manner of a whistle whereby the completion of the process of decoction is indicated in an audible manner. In case of Fig. 1 all the containers can be made of ordinary non-fireproof glass.

The embodiment shown in Fig. 2 differs from the embodiment according to Fig. 1 by the fact that heating of the steam-generating container g is effected by means of a spirit lamp. Another difference consists in that the spout b_1 is not applied to the water container b itself or a bordering metal ring b_2 fixed thereto, a separate ring b_3 being inserted between containers a and b provided, one one side with said spout b_1 and, on the other side, with a pipe branch h_3 to pass the steam generated in container g into the container b. The said ring b_3 may be made of glass or metal as desired, the advantage of the arrangement shown in Fig. 2 consists in that the water container b may be constituted by an ordinary drinking glass or a coffee or tea cup. In Fig. 2, we have shown by dotted lines that the spout b_1 might also be arranged at the bottom of the water container b in which case, of course, the upper spout b_1 may be dispensed with.

According to Fig. 3, we provide for a number of units, each composed of an extraction container a and of a water container b, a common steam-generating container g to which all of the coffee or tea extracting devices join on separately in such manner that each of them may be disconnected from said steam-generating container g independently. Thus, if the water container b is constituted by the drinking cup or drinking glass itself it is possible to produce a decoction for direct consumption, which is particularly advantageous in view of its enabling a fresh decoction to be prepared immediately before consumption, e. g. in cafés or other public places. On Fig. 3, that place of the device where, at the moment, no decoction is taking place is shown as immediately adjoining the steam-generating container g; at this place, only the ring b_4 joining on to the steam discharge pipe h is visible and below said ring b_4 a cup b and above said ring an extracting container a has to be placed if it is desired to prepare a decoction.

The embodiment according to Fig. 4 differs from those described above mainly in that the steam-generating container g is separated from the apparatus and it is only the extraction container a and the water container b which are united by the yoke k. Another difference consists in the fact that the steam from the steam-generating container g is introduced into the water container b through the discharge pipe h and the spout b_1 intended also for pouring out the decoction after its preparation has been completed. The water container b of the device shown in Fig. 4 is adapted for being heated not only by steam but also by direct heating means, a spirit lamp i being shown therefore by way of example. Accordingly, if desired the said device may be also used without the steam-generating container g. Instead of the spirit lamp i shown, of course, heating by electricity or by gas may be used too.

Fig. 7 illustrates an embodiment in which the pipe branches h_1 and h_3 shown in Figs. 1 and 2 through which the steam is discharged from the steam-generating container g are arranged inside the device so as to extend upward inside the containers a_3 and b, respectively, like a pillar. Moreover, according to Fig. 7, the container b containing the extraction water is arranged on top whilst the container a_3 containing the strainer f is arranged in the middle. The strainer f is inserted between the steam pipe branches h_1 and h_3 into the path of flow of the steam. The lower steam pipe branch h_1 ends at the top below the strainer f, in the immediate vicinity of the latter, and is formed here with a discharge opening h_4, whereas the upper steam pipe branch h_3 is followed by a pipe m bent back and ending, at its lower opening m_2, in the vicinity of the bottom of the container b below the level of water filled into said upper container b. The said arrangement results in a pipe line having a syphon effect as will be explained in greater detail below. In order to enable the pipe m to be cleaned, we prefer to make the said pipe of a separate piece which is inserted into the steam pipe branch h_3. We further prefer to make the free throughflow cross-section of the pipe m adjustable, for instance by means of a screw spindle m_1.

The apparatus shown in Fig. 5 operates in the following manner:

The steam generating container g is heated in any desired manner, e. g. by placing it directly on a gas heater, or by means of a spirit lamp, or by means of a built-in electric device, etc., and the steam generated therein flows over the path indicated by the arrows A into the extraction

water placed into the container b, thereby gradually heating the said water and finally causing it to boil, which latter condition may be recognised, among other indications, also by the fact that the steam flowing out through the whistle a_1 will give an audible acoustic signal. As soon as this occurs, the heating of the steam-generating container g is discontinued. The steam, accumulating during heating in the container a_3 also, will, owing to the coolingdown taking place after the discontinuation of the heating, become condensed and in consequence thereof a vacuum will be set up in the container a_3, by which vacuum the hot extraction water will be drawn down from the container b through the syphon pipe line m, h_3 into the container a_3 and during its passage the hot water will parboil the coffee or tea placed on the strainer f. The flow of the water through the syphon pipe m, h_3 will continue as long as the lower outlet opening m_2 of the pipe m is below water. The decoction accumulates in the container a_3 and can be poured out through the spout b_1. In order to facilitate this, we employ the yoke k shaped as a handle already described in connection with Fig. 1. According to Fig. 7, the said yoke k may be supported by means of its extension k_2 in a rotatable manner in a pipe g_3 soldered into the steam-generating container g, preferably made of metal, so that for the purpose of dismantling the device, after loosening the screw k_1, the said yoke k can be tilted aside.

We prefer to make the containers a_3 and b of glass although they may also be made of metal. We further prefer the said steam pipe branches h_1 and h_3 to make integral with the containers a_3 and b, respectively.

The embodiment according to Fig. 7 is suitable for the production of a decoction of coffee and tea of the highest possible quality, because it is only once from above that the coffee or tea placed on the strainer f is parboiled by water at boiling temperature, whereas, e.g. in case of Fig. 1, the water passes through the layer of coffee or tea twice which may result in such flavouring substances also being extracted as may not suit everyone's taste. Moreover, the device according to Fig. 7 is also highly suitable for the production of a mixture of coffee and milk, because the milk which, as well known, is not well suitable for parboiling coffee or tea, may be placed previously in the container a_3 where it will become mixed with the decoction prepared only with the aid of the water contained in the container b, the said mixing taking place but subsequently when the decoction has been already effected.

Figs. 8 and 9 are illustrating a type of device comprising container b for the supply of extraction water fitted with a syphon pipe m, h_3 similar to that as shown in Fig. 7. In case of Figs. 8 and 9, however, the container a_3 containing the strainer f is not fitted with a bottom as in the case of Fig. 7 rendering the said container a_3 suitable for the collection of the ready decoction. Accordingly, in the case of Figs. 8 and 9, the ready decoction passing the strainer f flows into the steam generating container g itself. The method of operation of the device shown in Figs. 8 and 9 is, accordingly, in principle, similar to that explained in connection with Fig. 7, a difference existing only in so far that in the case of Figs. 8 and 9 it is in the steam-generating container g itself that the completed coffee or tea decoction accumulates. The clamping yoke or handle k is in this case capable of being tilted around the journals k_4 of the metal ring k_3 surrounding the container g, as clearly shown in Fig. 9.

Fig. 10 represents a device partly identical with that shown on Figs. 8 and 9, in so far as the lower container g and the middle container a_3 are identical, but the upper container b of Figs. 8 and 9 is replaced by a container a such as shown e. g. in Fig. 1 and which, accordingly, comprises the rising pipe d and the strainer f. In order to replace the upper container a according to Fig. 10 by the upper container b according to Figs. 8 and 9, it is also necessary to remove the strainer f according to Figs. 8 and 9, and in addition thereto the container a according to Fig. 10 has be made of such height and with such diameters as to enable the container a to be used for replacing the upper container b according to Figs. 8 and 9, and to be pressed down by means of the same yoke k. If the coffee and tea-extracting device is supplied to the public with two kinds of upper containers according to Figs. 8, 9 and 10, the public will thereby come into possession of a set capable of being used in two different ways, according to two different methods of extracting coffee or tea.

Fig. 11 represents a simplified embodiment of the device according to Fig. 7, in which the electric heating members j and j_1 are mounted into the container b containing the extraction water and fitted also with the syphon pipe h_3, m as described in connection with Fig. 7.

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PUBLISHED
APRIL 27, 1943.
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DEVICES FOR EXTRACTING COFFEE AND/OR TEA
Filed March 7, 1939

Serial No.
260,412
4 Sheets-Sheet 1

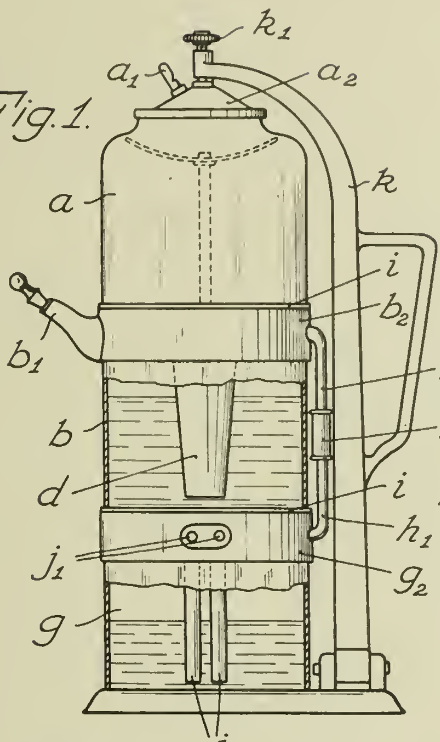

Fig. 1.

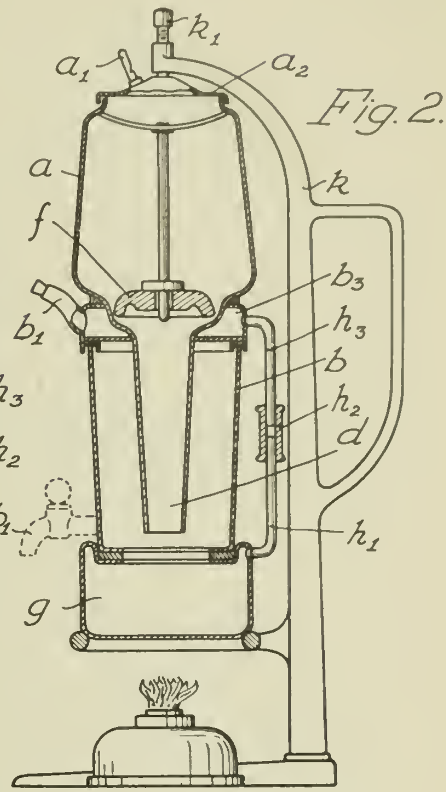

Fig. 2.

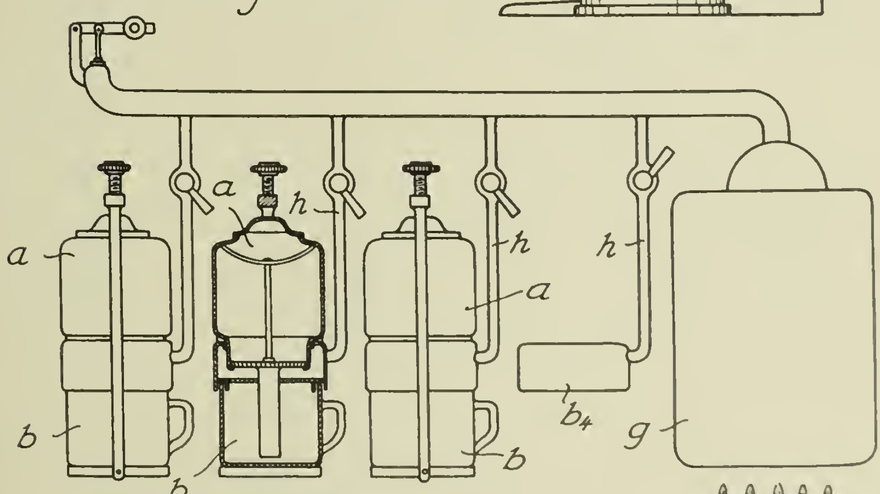

Fig. 3.

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DEVICES FOR EXTRACTING COFFEE AND/OR TEA

Filed March 7, 1939

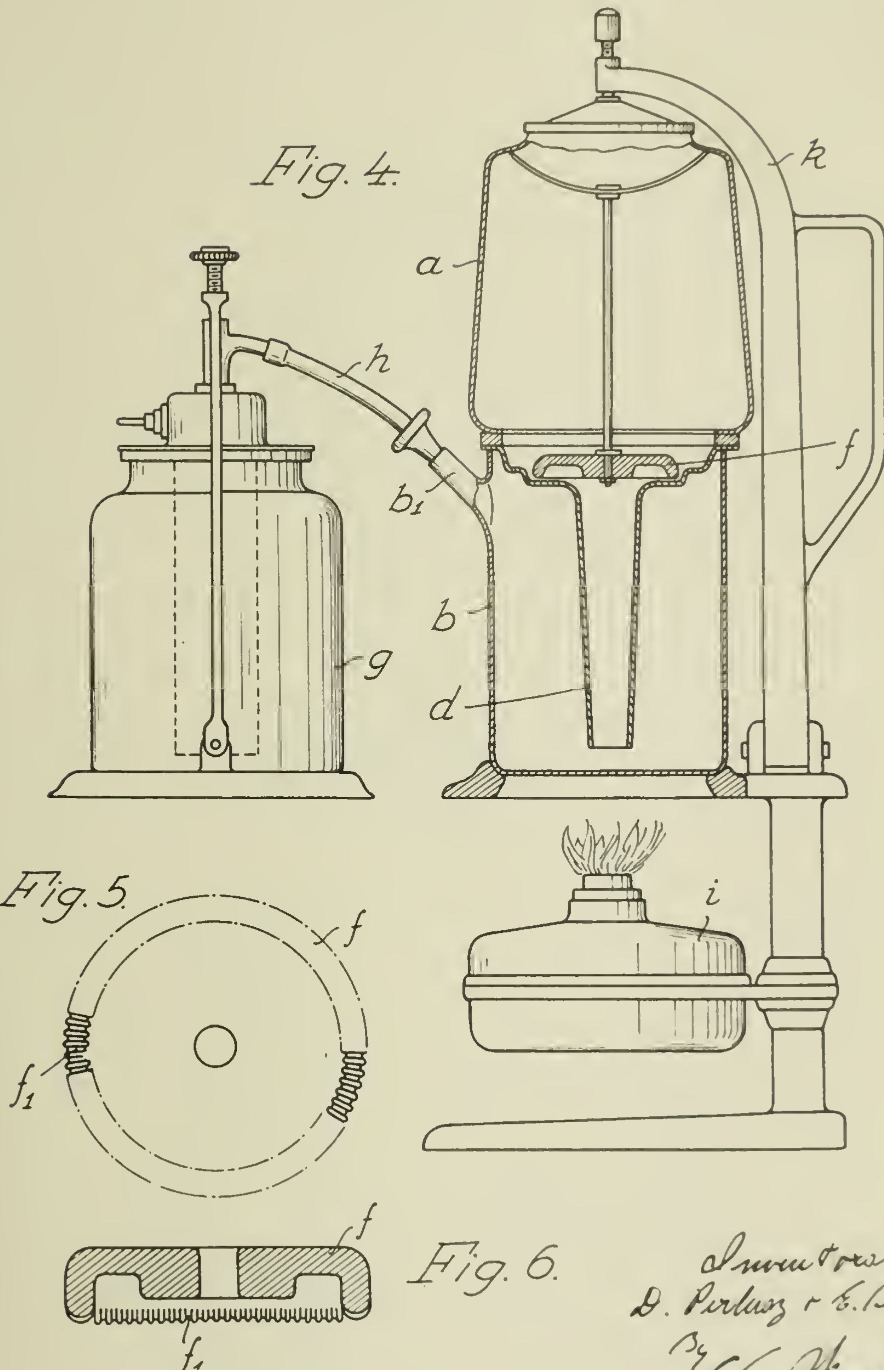
Serial No. 260,412

4 Sheets-Sheet 2

Fig. 4.

Fig. 5.

Fig. 6.



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APRIL 27, 1943. DEVICES FOR EXTRACTING COFFEE AND/OR TEA 260,412

BY A. P. C. Filed March 7, 1939 4 Sheets-Sheet 3

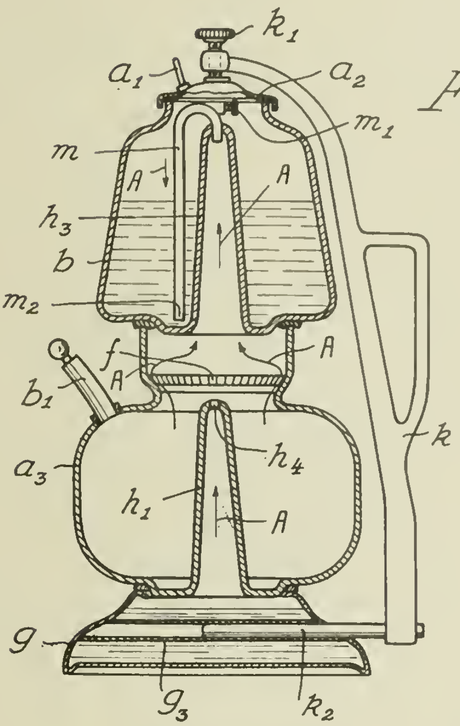


Fig. 7.

Fig. 8.

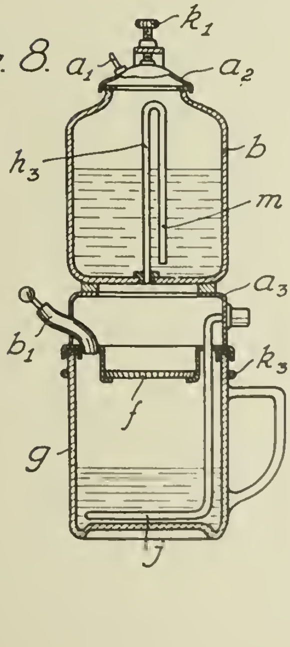
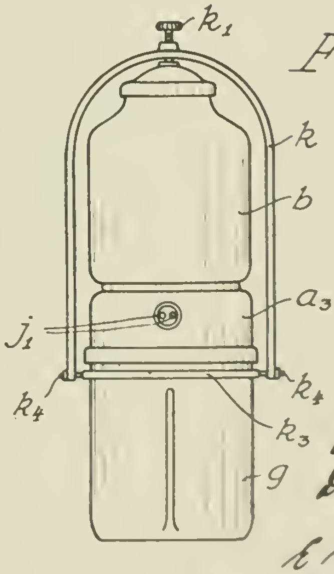


Fig. 9.



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PUBLISHED
APRIL 27, 1943.
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DEVICES FOR EXTRACTING COFFEE AND/OR TEA

Filed March 7, 1939

Serial No.
260,412

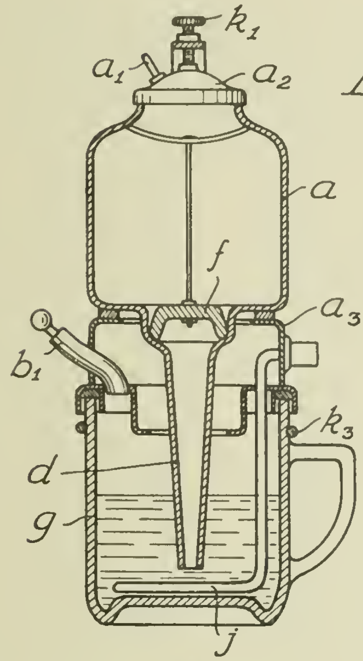

Fig. 10.

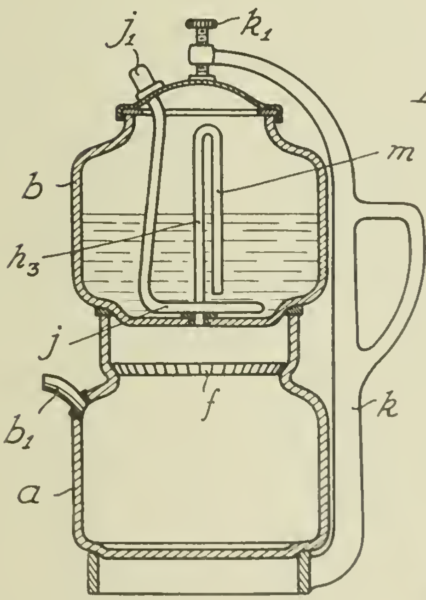

Fig. 11.

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Published Apr. 27, 1943 Serial No. 261,139

ALIEN PROPERTY CUSTODIAN

PRESSURE RESPONSIVE SYSTEM

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Application filed March 10, 1939

This invention relates to a system in which a novel hydraulic means is used to actuate a member in response to a control member.

Hydraulic control systems are old in which a fluid under pressure is applied to a member to be moved in response to a control member. In such hydraulic systems, the fluid is usually oil or water, such fluid being non-compressible. Such fluids are capable of imparting to the member to be actuated only the direct force which is given to them by a pressure producing member, and are incapable of storing energy to be expended as an additional force by themselves.

It is an object of this invention to create and apply a new medium for the transfer of forces in a hydraulic control system.

Another object of the invention is to create and apply a medium for use in hydraulic control systems, which medium has energy stored therein in addition to the force given the normal hydraulic fluid, such stored energy being expended against a member to be actuated in addition to the hydraulic thrust of the fluid alone.

Another object of the invention is to create a hydraulic control system, which, by the use of a new hydraulic medium, minimizes the lag between the initial movement of the hydraulic medium and the application of the thrust upon a member to be actuated.

A further object of the invention is to construct a hydraulic system for using a novel hydraulic medium, by reason of which the weight of the apparatus comprising the system, the power consumption, and the size of the apparatus are materially reduced over normal hydraulic control apparatus.

Another object of the invention is to create an elastic compressible medium capable of having energy stored therein for use in a hydraulic control system.

Another object of the invention is to create a hydraulic medium composed of a mixture of fluid and a gas.

Another object of the invention is to construct a hydraulic control system in which the hydraulic medium comprises a mixture of a fluid and a gas which is transmitted in response to a control member in compressed state to an actuating member, the energy of compression being expended against the actuating member.

A further object of the invention is to construct a system for actuating the throttle of an internal combustion motor, such as an aircraft motor, which system uses a novel hydraulic medium composed of a mixture of a fluid and a gas, and, as a result, a weak control impulse can be applied with a minimum of time and a surety of operation through the hydraulic system to the throttle valve.

Generally, these objects of the invention are obtained by employing a hydraulic system comprising a pump, a control member and an actuating member, the hydraulic medium being composed of a mixture of a fluid and a gas which is compressed by said pump and passed to the actuating member, the energy stored in the compressible medium by the pump being expended against the actuating member. By use of the compressible medium, the quantity of fluid used, the loss of pressure in transmission from the pump to the actuating member, and the size of the apparatus necessary for transmitting a predetermined force is materially reduced over conventional hydraulic systems in which fluid only is used. The amount of energy stored in the hydraulic medium by the compression of the gas in the fluid can be predetermined, and can be regulated by varying the quantity of gas passed to the pump.

A means by which the objects of this invention may be obtained is shown in the accompanying drawing, in which:

Fig. 1 is a diagrammatic view of an apparatus employing the novel system, the principal elements of the system being shown in section; and,

Fig. 2 is an enlarged cross sectional view of the pump shown in Fig. 1.

The novel system is shown in Fig. 1 adapted for the control of a throttle valve in the intake manifold of an internal combustion engine. Oil is taken from supply tank **2** through pipe **4** to one side of pump **6**, illustrated as a gear pump. Air is introduced into the other side of pump **6** through opening **8**. In the pump, the oil coming from conduit **4** is taken by gear **10**, and the air entering opening **8** is taken by gear **12**, the air and oil being mixed together by the engagement of the teeth of the pump, and the mixture of air and oil is discharged through conduit **14** to be compressed therein.

As air is mixed with the oil, a new hydraulic medium is created, and because of the compression of the air, energy is stored in the hydraulic medium passed into pipe **14**. The amount of energy created in the medium by the compression can be regulated by the quantity of air admitted through opening **8**, and, if desirable, compressed air can be admitted into opening **8**, which, of course, will create a greater stored energy in the hydraulic medium discharged through pipe **14**.

From pipe 14 the hydraulic medium is conveyed through branch pipes 16 and 18 to opposite ends of a control valve cylinder 20. From pipe 14 an excess pressure line 22 is returned to the supply tank, a pressure release valve 24 being contained in line 22.

From the center of control cylinder 20, a return line 26 extends back to the supply tank.

Mounted within cylinder 20 is a piston having spaced heads 28 and 30. Piston heads 28 and 30 are connected by a rod 32 which is movable to move the heads in response to variations in control member 34. Control member 34 may be responsive to changes in speed of an engine as determined by a governor, a temperature responsive device, a pressure responsive device, or any element capable of giving movement to the rod 32 in response to changes in a given condition.

From the opposite side of control cylinder 20, and from opposite sides of the cylinder heads 28 and 30, respectively, pipes 36 and 38 extend to opposite sides, respectively, of a casing 40 which houses a movable piston 42, said piston being pivoted at 44. Gear 46 is connected to the piston to be moved thereby, and, in turn, move rack 48. Rack 48 is connected by link 50 to throttle valve 52 in manifold 54.

The operation of the system is as follows: Gear pump 6 simultaneously takes fluid from the tank 2 and air through the opening 8 and mixes the two together, placing the mixture under compression. This hydraulic medium, comprising a mix of compressed air and fluid, is passed through pipe 14 to the opposite ends of control cylinder 20. Upon movement of the piston to the left in Fig. 1 in response to a change in control member 34, conduit 18 is brought into communication with conduit 38, while, at the same time, piston head 28 opens communication between return pipe 26 and conduit 36. The hydraulic medium comprising the mixture of oil and air passing through pipe 38, is discharged against piston 42 in housing 40, and movement of the piston takes place to the left in the direction indicated by the arrow *a*. By reason of the compression of the air, the movement of the piston 42 is caused both by the hydraulic thrust of the hydraulic medium and by the release of energy from the medium by the expansion of the compressed air. As the gear 46 is joined to movable piston 42, said gear is rotated to the right, and, in turn, moves rack 48 and link 50 to vary the position of throttle valve 52 in conduit 54.

It is clear that upon a reversed change of control member 34, the piston heads 28 and 30 will be moved to the right in Fig. 1 to open communication between pipes 16 and 36 and apply pressure upon piston 42 through pipe 36 to move the piston to the right.

The pipes 36 and 38 are made as short as possible so that the hydraulic medium, after passing through control cylinder 20, can act immediately upon piston 42. Therefore, the energy stored in the hydraulic medium is substantially instantly expended against piston 42, and movement of the piston 42 takes place without any lag after rod 32 has been actuated in response to changes of control device 34. A drop in pressure in housing 40 because of the expansion of the gas in the mixture is at once compensated for by the further delivery of the hydraulic medium from pump 6. This constancy of pressure maintained between the pump 6 and housing 40 is stabilized by the compression of the gas in the hydraulic medium, and thus a rupture of the pressure column between pump 6 and housing 40 is prevented, such ruptures being possible where only fluid is used as the hydraulic agent. The compression of the gas further allows a smooth and shockless operation of the piston 42 under the hydraulic medium. By reason of the expansibility of the hydraulic medium, the dimensions of pump 6 can be made smaller than the dimensions of conventional hydraulic pumps, and the force necessary to drive the pump can be smaller. Furthermore, in order to make the piston 42 responsive to a hydraulic fluid without admixed gas, the pump output must be two to three times as great as the output necessary merely to cause an actuation of the piston 42, while the excess quantity of fluid must be maintained in constant circulation between the pump and the supply tank against the pressure of valve 24.

With the use of a gas and liquid medium, the pump needs to have an output only about one-fourth of the quantity of oil which would have to be used if oil alone were used as the pressure agent. The quantity of fluid maintained in constant circulation between the pump and the supply tank is accordingly very much smaller, and therefore the weight of the pump, as well as the size and power requirements of the pump, are correspondingly less. The reduction in the amount of oil needed to be continuously circulated further reduces the undesirable additional heating of the supply tank as a result of the heat produced in recirculating the oil.

HANS WALTENBAUER.

PUBLISHED
APRIL 27, 1943.
BY A. P. C.

H. WALTENBAUER
PRESSURE RESPONSIVE SYSTEM
Filed March 10, 1939

Serial No.
261,139

Fig. 2

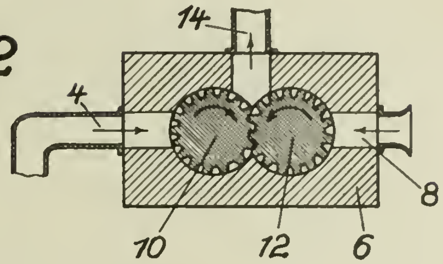
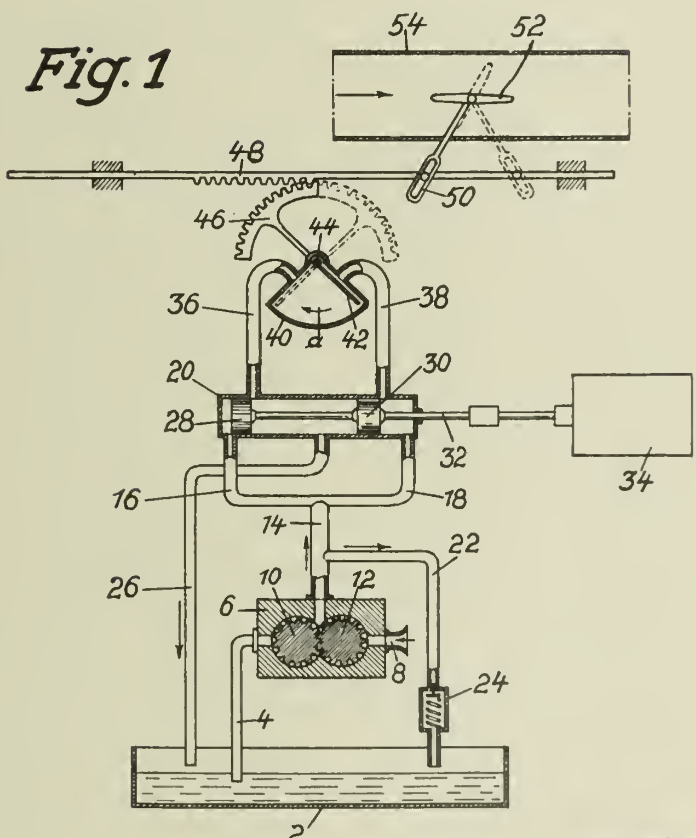


Fig. 1



Hans Waltenbauer
Inventor:

By Bailey & Larson

Published Apr. 27, 1943 Serial No. 262,245

ALIEN PROPERTY CUSTODIAN

DRYING PRINTED WEBS

Hans Fischer, Augsburg, Germany; vested in the Alien Property Custodian

Application filed March 16, 1939

When drying goods in motion such as for instance the pigments dissolved in volatile liquids on a moving web in rotary photogravure printing, commonly air is used as the medium for applying the heat necessary for the evaporation of benzol, toluene, xylol and the like which air is either blown upon the web or caused to travel along the same path. The use of air for drying has however a number of drawbacks. Operating with drying air which is mixed with the vapors of the volatile solvents and diluents of the pigments is, because of their inflammability in the presence of oxygen necessarily dangerous. Thorough drying moreover requires various extensive devices and above all the recovering of the evaporated solvents which because of their high price is of great importance, cannot satisfactorily be effected in any process based on the use of aircurrents. There are practically two known ways to recover these vapors: the condensation process and the adsorption process such as the process operating with active-carbon. The condensation process which especially relative to the required plant is the simpler process where vapors such as are generated in rotagravure printing are to be recovered, has not in practice been applied to any extent. The prime condition for this process being that the drying air on leaving the drying device is highly enriched with the vapors of the solvent, a condition that cannot safely be satisfied in rotagravure printing because of the great danger of fire which the high contents of inflammable vapors-entails. It is of course conceivable to operate with air enriched to a degree lying above the point where there is danger of explosion. But here also arise dangers when for instance the drying chamber is opened to rejoin the ends of a broken web in which case the quantity of explosible gases may be instantly reduced to the point of explosion. Hence it is only feasible to operate with air enriched below the limit of danger by explosion. In this case however only such quantities of the vapors will be recovered which exceed the saturation point at the given cooling temperature. The air leaving the condenser is still fully saturated relative to the degree of temperature at which it leaves the condensor.

Lately to a great extent in rotagravure printing plants and elsewhere, in combination with drying by air, so-called adsorption plants have been employed which are based on the adsorptive capacity of active carbon for the vapors of volatile solvents. In these plants the dangers of ignition are by no means evaded, neither can it be avoided that escaping vapors contaminate the breathing air of the work room, since plants of this description where the air travels through long drying channels are necessarily operated at relatively high pressure. Such plants moreover require a rather large equipment and consequently a very considerable initial expenditure of capital, costs which are increased by the rent of the large space which the plant occupies and the cost of continually watching it in operation. Among the necessaries wanted are adsorption containers for receiving the active carbon, air heaters for the drying air, ventilators which press the mixture of air and vapors through the drying tract, and others for pressing it through the carbon, generators of steam for treating the carbon, air heaters and fans for drying the carbon, and so on.

The object of the invention is to provide a process and a device for drying printed webs while in motion which avoid the above mentioned drawbacks and which also make it possible to apply the essentially simpler condensation process tried in other trades for recovering volatile solvents, for instance in rotagravure printing where hitherto its application has been impossible owing to the high degree of dilution by air of the vapors of the solvent.

The invention consists in the utilization of steam instead of air for drying the goods mentioned, more especially superheated steam in order to avoid precipitation on the goods to be dryed. The drying chamber through which the moving goods are passed will agreeably to this purpose be connected on one end with a generator of superheated steam, and on the other with a condenser.

The drawing, a sectional view, shows by way of example a preferred form of the object of the invention as applied to a rotary photogravure printing machine.

The moving goods, in this case a web 1 passes between a forme cylinder 2 and the impression cylinder 3, and then over the drying drum 4. Partitions 5 and 6 disposed in known manner parallel to the surface of the drying drum form a channel 7 into which superheated steam enters by nozzles 8 and 9 of a steam generator not shown. The drawing channel 7 is by piping 10 connected with an injecting condenser 11. The superheated steam streams from the drying chamber 7 through the piping 10 into the condenser 11 and will as water 12 be precipitated which collects in the separator 13. The vapors of the solvents will also be precipitated in liquid

form and also collect in the separator 13 as a layer 14 on top of the water 12. Either of the liquids may be withdrawn from the separator by separate discharge pipes 15 and 16. The pipe 17 serves to deliver the cooling water. The vacuum forming in the condenser at the same time removes the steam from the drying channel. The condenser thus operates as a vacuum pump the efficiency of which automatically adjusts itself to the quantity of the arriving steam.

Since there is initially no steam in the condenser when the printing machine is started and consequently no vacuum is at first created, a special pipe 18 is provided which at the start supplies superheated steam. The supply of superheated steam through the pipe 18 is cut off after the printing machine is started.

For economical working the supply of superheated steam to the nozzles 8 and 9, and also the supply of cooling water to the condenser is, agreeable to the purpose, made to depend on the speed of the printing machine.

In place of the injecting condenser a surface condenser may be provided.

The new process and the new device avoid all danger from ignition or explosion and in addition to the outward simplification of the machine and the recovering plant there is the advantage that the whole of the solvent vapors are completely precipitated in the condenser. The plant moreover operates at a pressure approximating atmospheric pressure and consequently allows of almost perfect packing which is of value both on account of the thereby effected saving of vapors and the freedom from vapors in the air of the workroom. An additional advantage of the new arrangement is the extraordinarily small space occupied by the recovering condenser which on certain conditions may even be joined directly to the printing machine.

HANS FISCHER.

PUBLISHED

APRIL 27, 1943.

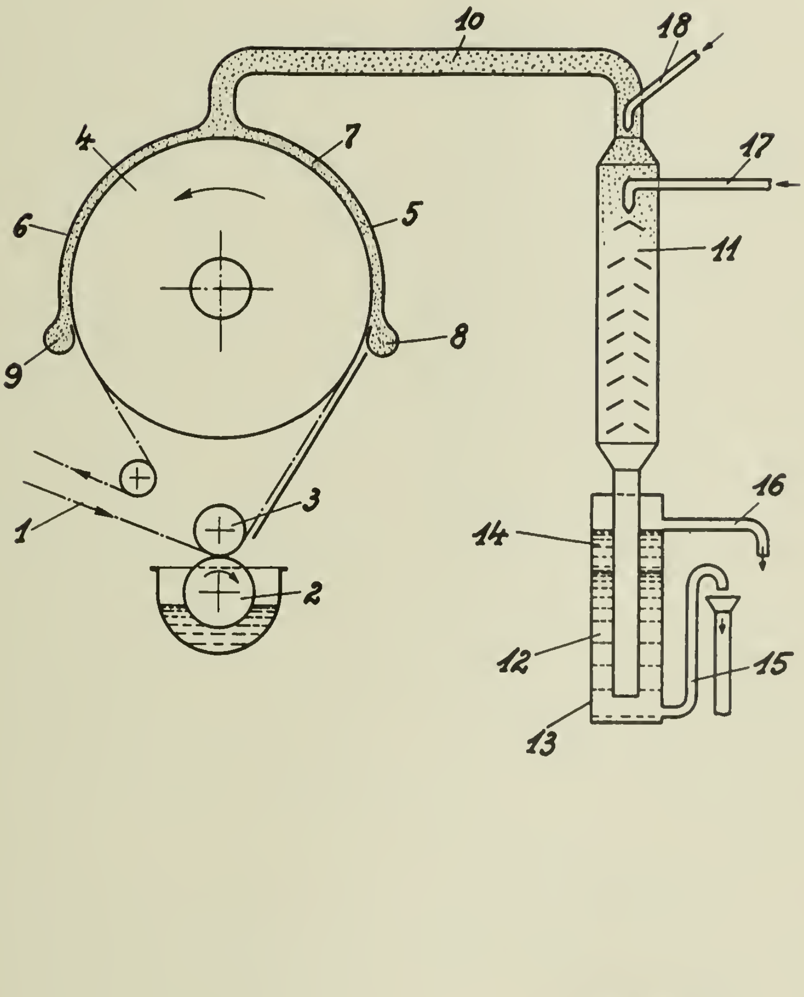
BY A. P. C.

H. FISCHER

DRYING PRINTED WEBS

Filed March 16, 1939

Serial No. 262,245



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Published Apr. 27, 1943

Serial No. 262,291

ALIEN PROPERTY CUSTODIAN

MILLING PLANER WITH SWINGEABLE TOOL-SPINDLE

Raimondo Bolaffi, Milan, Italy; vested in the Alien Property Custodian

Application filed March 16, 1939

The present invention concerns a milling-planer with a swingeable spindle.

The invention consists substantially in this, that, associated with means for supporting the work, which means can be moved at least in the two fundamental horizontal directions, there is a tool-carrying spindle, capable of being set to almost any angle relatively to an axis and movable in a direction at right angles with said axis, said tool-carrying spindle being capable of a fundamental straight alternating motion or of a rotational motion, so that the machine may perform planing, milling, boring or similar operations.

The invention will be now disclosed with reference to the attached drawing, which is given solely by way of an example, limiting in no way the range of the invention and to show a particular preferred embodiment of the machine according to the invention.

The attached drawing shows an example achieving the invention.

In the drawing: A is the base plate of the machine, on which rises a column or standard B, carrying the head C. On base plate A moves a table D for supporting the work, whilst within the basement are placed the various driving devices. Standard B is rotatable around its vertical axis by means of a hand-wheel 1 and can be fixed by the blocking device 2.

On head C is applied a motor 3, driving two spindles carrying the tools: these spindles are coaxial, spindle 4 can revolve around and spindle 5 can move straight alternatively along the common axis; either of these motions can be obtained by acting on lever 6 controlling the proper gears placed within shroud 7 in which is also the speed-change box.

The motor 3 moves the tube 8 along its own axis consequently also the spindles 4 and 5. The tube 8 can also be moved by hand by means of handwheel 9 and can be blocked in position by means of stops 9′ in any position required for the slotting operations. The group of spindles 4 and 5 with their driving motor, can be set at any angle by rotating them on the face of guide plate 10.—The displacement of head C is obtained either by hand, with hand-wheel 11 or automatically, by means of motor 12, according to the speed required for said displacement and its importance.

The work-carrying table D has two carriage 13, 14, this latter placed on the top of the former and moving at right angles to the same. Carriage 14 carries a rotatable table 15, whereupon the work is fixed; this table is moved by a hand wheel 16, whilst hand-wheels 17 and 18 are used for moving carriages 13 and 14 respectively. Table 15 can be fixed in position through outside jaws 19, tightened by bolts, screws or the like. The lead screws moving the carriages and the lead screw of standard B are with a decimal pitch to allow an easy reading, with the required accuracy, and by means of proper adjusting lines, of the displacement of the moving members.

The machine according to the invention allows operations to be performed which cannot be obtained on every single machine-tool of the sort said machine represents: in fact this machine can bore, mill, plane or slot.

The rotation of standard B and the angular settings allowed for head C allow any of the above operations to be performed in any position of the work and under any desired angle (as, for instance, the milling or slotting of the openings for scavenging air in the Diesel engine sleeves).

Moreover the invention allows the planing of curved surfaces, both concave and convex, by means of proper devices applied to the cutter-carrying spindle 4, and driven by the spindle with an alternating motion. Said motion, of spindle 5, is adjustable in stroke and provided with a quick return. The stroke is adjustable according to the requirements.

It should be understood that, in practice, the details of design and of application may vary without exceeding the limits of the invention and therefore those of its protection.

RAIMONDO BOLAFFI.

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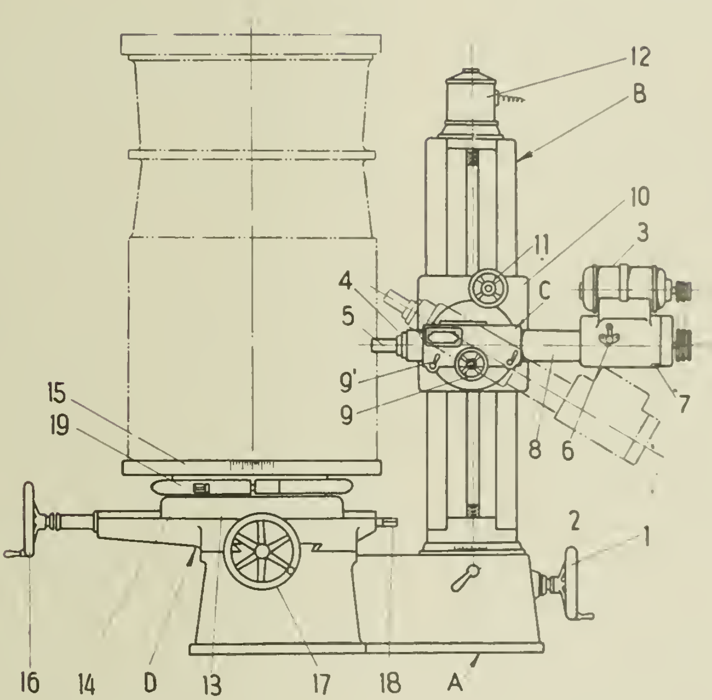
PUBLISHED R. BOLAFFI Serial No.

APRIL 27, 1943. MILLING PLANER WITH SWINGEABLE TOOL-SPINDLE 262,291

BY A. P. C. Filed March 16, 1939



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Published Apr. 27, 1943

Serial No. 263,042

ALIEN PROPERTY CUSTODIAN

REGULATING THE OPERATION OF A GAS PRODUCER

Cyrille Alfred Alexis Bazille, Gennevilliers, France; vested in the Alien Property Custodian

Application filed March 20, 1939

In the utilisation of gas producers with a view to producing "water gas" it is usual to proceed, preferably automatically, by regular cycles each comprising two successive phases: air blowing and injection of water vapour.

The first phase has the effect of bringing a mass of coke contained in the gas producer to the temperature most suitable for ensuring the decomposition of the water vapour injected during the second phase, and consequently the desired production of water gas.

However, the reaction of the water vapour on the coke is endothermic, so that during the course of the vapour injection phase the temperature of the coke constantly decreases; as the reaction is reversible, it becomes more complete in proportion as the temperature is increased; consequently, the proportion of decomposed vapour decreases also from the beginning to the end of the injection phase.

Moreover, the rapidity of decomposition of the water vapour depends upon numerous other factors: cooling of the mass of coke by conductivity of the walls of the gas producer or by the carrying away of heat by the non-decomposed vapour, the length of time the water vapour and the incandescent coke are in contact with one another, the speed of displacement of the water vapour and of the gases in the interstices of the mass of coke, and relative proportions of the constituents of the mixture of water vapour and gas.

In order to obtain optimum results, the most favourable duration for one complete cycle, for example three minutes, and the necessary distribution of the two phases, air blowing and injection of vapour, in the cycle, for example one minute of blowing for two minutes of injection, have hitherto been determined for each gas producer by calculation or by numerous tests.

In all cases, the rate of the injection of water vapour has been maintained constant from the beginning until the end of the injection phase regardless of the time sequence adopted.

The object of the present invention is further to improve the working of a gas producer by ensuring, during the period of the vapour injection, a decreasing rate of delivery either continuously or in phases, or finally in successive pulsations.

In all cases, the mean vapour delivery at the beginning of the injection phase is much greater than the delivery at the end.

This process of regulating the injection of vapour improves the conditions of operation of the gas producer, because for the same weight of injected vapour, there is obtained either a richer gas or a greater quantity of gas per cycle, that is to say, a substantial increase in the production.

The possibility of one or more pulsations in the law of variation of the delivery has the effect of creating each time a sudden increase in the velocity of flow of the gases, and consequently of causing the breakage of the stationary gaseous film, which, as experience has shown, tends to form about each piece of coke and forms an obstacle to the decomposition of the water vapour.

The regulating process according to the invention may be automatically effected by means of a closing member arranged on the steam delivery conduit and mechanically actuated in such a manner that its movable part leaves free an inlet area which decreases during the course of the injection phase in accordance with the law fixed for the delivery to be effected at each instant.

In a first embodiment, such a closing device may be constituted by a fixed diaphragm having suitable apertures against which there is applied a movable diaphragm, also apertured, which rotates continuously; the inlet area is constituted by those parts of the apertures of the two diaphragms which lie in coincident positions.

In a modification, the closing member is constituted by a form of profiled valve having an axial lift and controlled by a continuously actuated cam of suitable profile.

Suitable safety systems are combined with these devices for the purpose of stopping the operation of the gas producer if the closing member is accidentally held fast.

The invention is illustrated by way of example in the accompanying drawings, in which:

Figure 1 is a longitudinal section through a first constructional form of the regulating arrangement according to the invention;

Figure 2 is a front view of the fixed diaphragm;

Figure 3 is a front view of the movable diaphragm;

Figure 4 is a view of a safety member of the arrangement;

Figure 5 is a graph representing the inlet area during the course of operation;

Figure 6 is a longitudinal section through a modification of the arrangement;

Figure 7 is a cross-section along the line VII—VII of Figure 6;

Figure 8 is the graph representing the inlet area during the course of the operation of this modification.

The arrangement shown in Figures 1 to 4 comprises an inlet branch 11 and an outlet branch 12 intended to be interposed between any two

elements of the conduit delivering the vapour to the gas producer (not shown).

The two branches are connected by screws 13 and at the joint the inlet branch 11 contains a fixed diaphragm 14 covered by a diaphragm-supporting plate 15. This plate, which is secured by screws 16, plays a purely mechanical part and serves to reinforce the diaphragm 14, which is thin and may thus be constructed with great precision.

As is shown in Figure 2, the fixed diaphragm has an aperture 17 of generally arcuate form, the width of which, considered radially, continuously decreases. The diaphragm-supporting plate 15 is also apertured, but its aperture 18 is systematically larger than the aperture 17 of the diaphragm, so that it in no way influences the operation.

Against the fixed diaphragm 14 is applied an apertured movable diaphragm 19 (Figure 3) comprising an arcuate aperture 21 of the same general form as the aperture 17 of the fixed diaphragm 14 but having a smaller angular extent than that of the fixed diaphragm. In the example shown, the aperture 17 extends over about ⅔ of a circumference, while the aperture 21 of the movable diaphragm extends only over half of a circumference.

The movable diaphragm 17 is carried on the extremity of a rod 22 which extends by means of a stuffing box 23 through the wall of the inlet branch 11. The rod 22, which is retained by a ball thrust bearing 24, carries at its outer extremity a sprocket wheel 25 over which there passes a transmission chain (not shown) extending from a suitable continuously rotating driving member, owing to which the movable diaphragm 19 effects at constant speed one complete revolution per cycle of operation of the gas producer.

In order to ensure the safety of the installation there is provided on the movable diaphragm 19 a toothed rim 26 in engagement with a bevel wheel 27, the shaft 28 of which extends through the wall of the branch 11 at right angles and through a stuffing box 30 and carries at its outer end a pinion 29 in engagement with a second pinion 40 driving a shaft 31 on which a plate 33 is rigidly mounted.

On the shaft 31 is mounted, so as to turn loosely thereon, another plate 32 connected to a toothed wheel 34 over which there passes a chain (not shown) actuated by the general driving member of the arrangement at a speed of one complete revolution per cycle of operation of the gas producer.

The plate 32 comprises on its periphery a metal ring 35 electrically insulated, but connected nevertheless to a brush 36 provided with a spring and bearing against an arcuate contact member 37 (Figure 4), which is carried in suitably insulated fashion by the plate 33. The contact member 37 does not extend over a complete circumference and has an insulated gap 38 between its two extremities.

However, the said contact member 37 is electrically connected by a screw 39 to an insulated metal ring 41 surrounding the plate 33.

Two fixed brushes 42 and 43 are connected in an electric circuit so as to be in permanent contact with the rings 35 and 41, said circuit comprising the winding of a relay, the armature of which is adapted to ensure the placing of the gas producer "in suspension", that is to say out of operation. Such a relay is at present commonly employed in installations for the automatic control of gas producers and does not require to be particularly described.

The arrangement described in the foregoing operates in the following manner.

During the course of the first phase of one cycle (air blowing), the ordinary vapour injecting valve (not shown) is completely closed and the regulating arrangement is inoperative; however, the movable diaphragm 19 is turned in the direction of the arrow F (Figure 3). At the end of this phase of operation of the gas producer, the air blowing is stopped and the vapour admission valve is fully opened; at this precise moment, the two apertures 21 and 17 are in coincident positions and a maximum inlet area is offered by the arrangement to the vapour.

However, the movable diaphragm 19 is still turning in the direction of the arrow F and covers a wide part of the aperture 17, while it frees a narrower part. The inlet section therefore diminishes progressively until the diaphragm 19 has carried out about half a revolution.

From this moment, the inlet area remains substantially constant, since the diaphragm frees on one side approximately the same inlet area as it covers on the other side. Finally, after two-thirds of a revolution the vapour admission valve closes in the ordinary way and the injection of vapour ceases. A further cycle of operation then commences.

Figure 5 shows a curve prepared by plotting along the ordinates the inlet areas (or steam deliveries D) and along the abscissae the periods of fractions of cycles.

This curve has an exponential form turning its concavity towards the top. It will be understood that by replacing the two diaphragms by others having apertures of different form from those shown in Figures 2 and 3, a curve of different appearance would be obtained, from which it may be seen that the arrangement permits of regulating the injection of vapour in accordance with any desired law.

If by accident the movable diaphragm 19 stops, for example owing the breakage of the chain by which it is actuated, the plate 33 remains stationary, while the plate 32 continues to rotate.

As a result, the brush 36 is soon removed from contact with the contact member 37, the electric circuit is broken and the safety relay responds and suspends the operating of the gas producer.

The modification shown in Figures 6 and 7 comprises a tubular body interposed between two elements of the delivery conduit for the injection vapour. The tubular body 45 forms the seat 48 of a valve 49 of conical form, which is provided with guide blades 51.

The valve 49 is carried on the extremity of a rod 52 which traverses the tubular body 45 at right angles through a stuffing box 53 and which is connected by a link 54 to a rocker 55 pivoting about a fixed axis 56.

The other extremity of the rocker 55 is provided with a roller 60 in permanent contact with a cam 57 continuously rotating at the rate of one revolution per cycle of operation of the gas producer. A spring 58 surrounding the rod 52 of the valve tends constantly to return the valve to its seat as far as is permitted by the contour of the cam 57.

Transversely to the tubular body 45 is disposed a finger 50 intended to be encountered by the valve 49 when this valve bears completely against its seat, which may occur in the event of acci-

dental breakage of a part; such for example as the link **54**.

The finger **50** is carried by a transverse rod **59** extending from the body **45** through a stuffing box **61** and actuating outside this body an electric switch which controls the circuit of the safety relay of the installation.

This modification of the arrangement operates in the following manner:

At the end of the air blowing phase, the highest rise of the cam **57** is disposed below the roller **60**, so that in spite of the spring **58** the valve **49** is in its position of maximum opening.

At this moment, the steam admission valve is opened and the injection into the gas producer commences at a high rate.

However, the cam **57** in rotating first allows the valve **49** to approach its seat **48**, but another rise of the cam **57** is soon presented and the valve **49** is again opened but less than in its initial opening.

The closing movement of the valve **49** then recommences and atfer the passing of a further rise of the cam the inlet area freed by the valve progressively decreases until the end of the cycle.

Since the inlet areas and consequently the steam deliveries have accurately followed the displacements of the conical valve **49**, it follows that the injection of vapour has been effected in accordance with a law of both declining and pulsatory character, such as that represented by the curve in Figure 8.

Each pulsation corresponds to the presence of a rise on the cam **57** and it will be understood that it is sufficient to select a suitable profile for this cam in order to obtain any desired law of variation of delivery for the injection of the vapour into the gas producer.

Should a part be accidentally broken, the spring **58** forces the valve **49** on to its seat, whereby the finger **50** is forced back and causes the safety relay to respond.

It is obvious that the invention is not limited to the two examples of application which are described in the foregoing and that it is possible, without departing from the general scope of the invention, to utilise other forms of closing members for carrying out the regulating process according to the invention.

CYRILLE ALFRED ALEXIS BAZILLE.

PUBLISHED
APRIL 27, 1943.
BY A. P. C.

C. A. A. BAZILLE
REGULATING THE OPERATION OF A GAS PRODUCER
Filed March 20, 1939

Serial No.
263,042
2 Sheets-Sheet 1

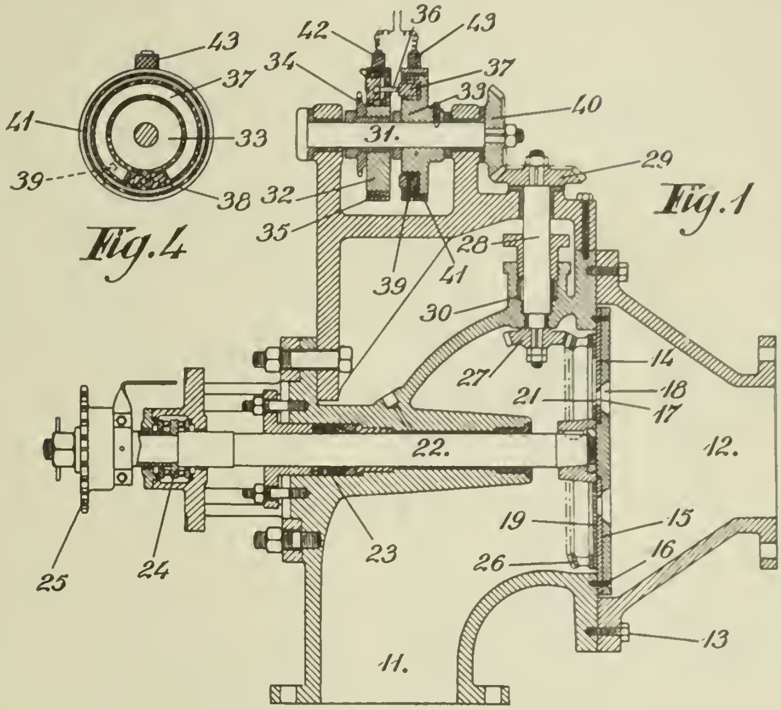
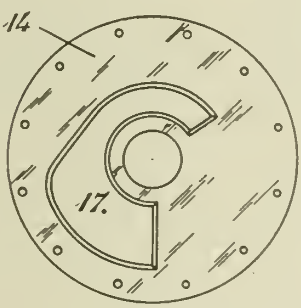


Fig.4

Fig.1

Fig.2



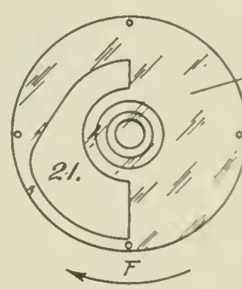
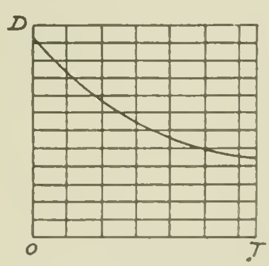


Fig.3

Fig.5



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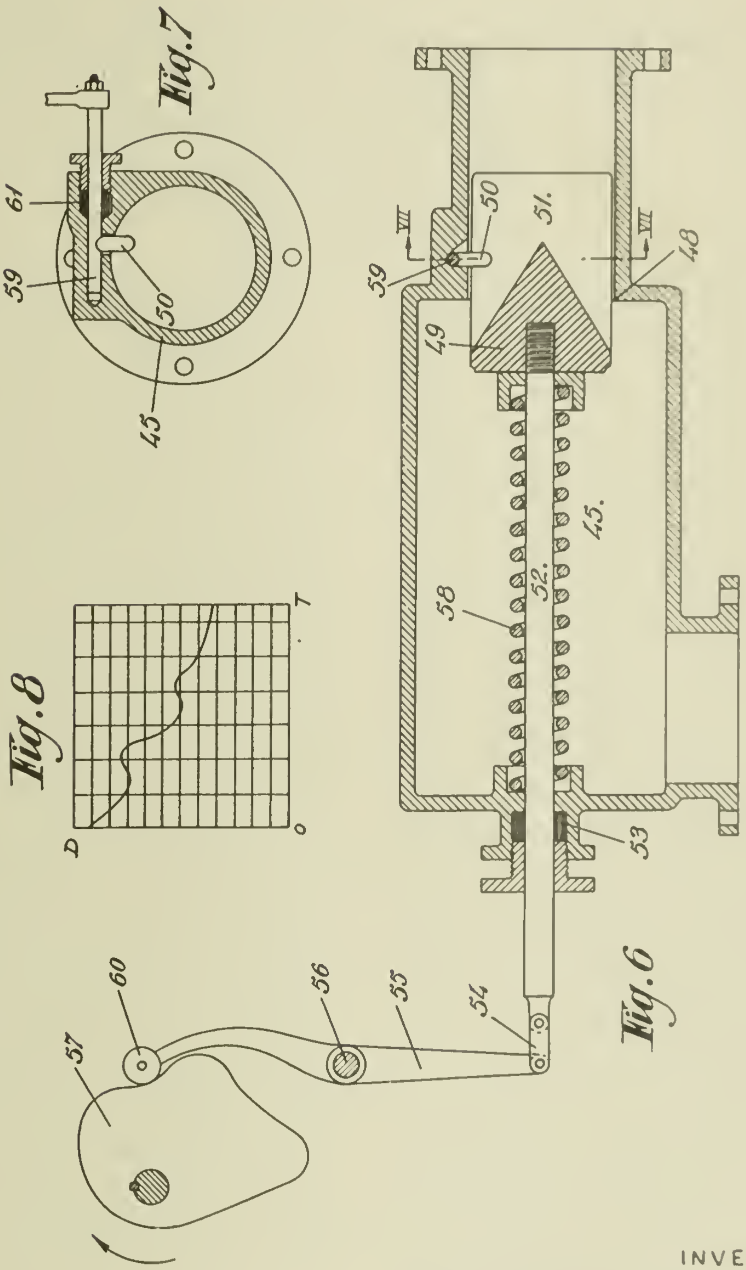
PUBLISHED	C. A. A. BAZILLE	Serial No.
APRIL 27, 1943.	REGULATING THE OPERATION OF A GAS PRODUCER	263,042
BY A. P. C.	Filed March 20, 1939	2 Sheets-Sheet 2



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Published Apr. 27, 1943

Serial No. 264,995

ALIEN PROPERTY CUSTODIAN

APPARATUS FOR PERFORMING ENDO-THERMIC CATALYTIC REACTIONS IN THE GAS-PHASE

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Application filed March 30, 1939

This invention relates to surface reactions and more particularly to catalytically induced chemical reactions which occur with substantial conversion between heat and chemical energy.

Chemical reactions between gases or vapors occur with endo- or exo-thermic effects. In many cases these effects are very serious and cause difficulties in keeping the temperature of the reaction at the desired level.

The amount of heat which has to be either removed or delivered to assure the uniformity of the process increases per unit of time and space in proportion to the increased velocity of the reaction in the presence of catalysts. The catalyst mass either increases in temperature or cools off irregularly. In case of endo-thermic reactions, if the heat supply is not satisfactory, the temperature drops and consequently also the rate of reaction drops; the reaction is not completed and sometimes even changes the desired trend.

The apparatus used at present for endothermic catalytic reactions in the gas-phase can be divided into two types with respect to the principles by which the heat is delivered for the reaction. The first type is based on an intermittent cycle of operation. A solid material, which usually serves also as a catalyst, is heated directly by combustion gases to the desired temperature; then in the next cycle it is used for the reaction until the temperature drops below a certain minimum. This intermittent operation is disadvantageous for reasons of low heat economy, relatively low capacity and contamination of the reaction products. In the second type of apparatus the heat is delivered continuously. The catalyst fills a space separated from the heating medium by walls, to which it is closely adjacent. Only this layer of the catalyst which is close to the heated wall receives enough heat; layers placed at further distances are at lower temperatures due to insufficient heat transfer into the catalyst mass.

One object of the present invention is to provide an efficient apparatus and process for performing catalytic reactions in the gas-phase, and wherein the temperature of reaction is controlled by efficient heat-exchange with substantially the entire surface of the catalyst.

Another object is to provide an apparatus where the reacting gases can mix freely and pass through a number of layers of the catalyst without chanelling.

Still another object is to provide an apparatus where the catalyst is used in thin layers and substantially at constant temperatures thus preventing mechanical deterioration.

Another object is to provide an apparatus giving high out-put per unit of catalyst used, thus permitting the economical use of relatively expensive catalysts and, if desired, a frequent change of catalyst.

These objects I accomplish by using a catalyst in relatively thin layers and effecting heat exchange by direct radiation from or to its surface at which reaction occurs.

The apparatus according to this invention is represented schematically in the accompanying drawings in which each of the Figures 1, 2 and 3 is a view in vertical section, more or less diagrammatic, of an apparatus embodying my invention adapted for endo-thermic catalytic reactions such as water-gas production.

The apparatus (Figure 1) has a reaction chamber 1 separated by a wall 2 from the heating space 3. The reaction chamber contains perforated trays placed at a distance from each other. On these trays is placed the catalyst in a rather thin layer 4. At the bottom of the heating space 3 are placed burners 5 fed by liquid or gaseous fuel. The heating space is insulated by an external insulating wall 6. Combustion gases may be used in preheating steam or in preheating gases entering the reaction chamber, or in heating a boiler. Gases for the reaction enter the reaction chamber 1 through a conduit 7 and leave through conduit 8 or they can be passed in reverse direction, counter-current to the flame. Reaction gases may be used directly when hot for further processing or can serve as a preheating medium for incoming gas. The distances between the trays and the thickness of the catalyst layers are suitably selected so that between the surface of the catalyst layer and the next upper tray there remains a rather large free space. The thickness of the catalyst layer can vary depending primarily on the activity and the size of the catalyst grain, its conductivity, as well as such factors as e. g. operating temperatures, the rate and the degree of endothermicity of the reaction and the amount of heat delivered by radiation of the wall to the unit of surface of the catalyst. These and other factors influence the thickness of the catalyst within a wide range. In most cases the thickness of the catalyst layers will range from $\frac{1}{4}$ to 2 inches but these figures are cited only as examples, and it is obvious that the thickness can vary within wider figures and the catalyst layer can be thinner or thicker without departing from the spirit of the invention.

Free spaces between catalyst layers are very important because these free spaces enable the heat to radiate from the heated walls of the chamber upon the surface of the catalyst and also to mix the gases of reaction. Generally the free spaces of the reaction chamber should be much larger than the spaces occupied by the catalyst.

The reaction chamber can have any suitable shape, e. g. a cylinder, a prism or a cone. Its walls are made of steel, or a special heat-resistant alloy or refractory ceramic material, depending upon the required temperature of reaction. The walls of the chamber are heated externally by any suitable means, e. g., liquid or gaseous fuel, and serve to radiate the heat or to transmit radiant heat to the catalyst and the reacting gases.

When a material which is relatively impermeable to radiant heat is used, the wall of the chamber itself must be heated to a temperature at which it becomes a good radiant source well above the required temperature at the surface of the catalyst. If, however, a material is used which is highly permeable to infra-red radiation, as for example silica or certain refractory glasses, etc., the wall of the reaction chamber may remain relatively cool, e. g., at the optimum reaction temperature, while transmitting radiant heat from a flame, hot gases or liquid or from a radiating body outside the chamber.

Although I have described this invention with particular reference to endo-thermic reactions, it should be understood that it is applicable also to exo-thermic reactions, i. e., those in which heat released by the reaction at a contact surface would tend to overheat the surface and to deactivate it or otherwise to injure the apparatus or to interfere with the desired progress of the reaction. In such case the removal of excess heat from the reaction zone by radiation to or through the wall of the reaction chamber in accordance with the invention herein disclosed gives a great advantage. The main amount of heat is furnished by radiation from or through the hot wall to the catalyst surface directly or by reflexion. Comparatively, only a negligible amount of heat is furnished to the inner zones of the catalyst by conductivity. This fact shows the advantage of using the catalyst in thin layers exposing a large irradiated surface. This way a uniform distribution of heat in the catalyst mass, especially at the surface where it is required for the reaction, and high performance of the catalyst are obtained.

The reaction chamber can also be shaped in another very advantageous form, namely, as an annular space between two concentric cylinders. The heating is done within the inner cylinder. The wall of the outer cylinder of the reaction chamber serves for heat reflexion and insulation purposes; or additional heat radiation may be supplied through the outer walls.

This form of apparatus permits the use of a central flame, avoiding difficulties of shaping and regulating the burners around a cylindrical reaction chamber, and also further improves the thermal efficiency of the apparatus. The analysis of the radiant-heat-transfer from an outer jacket (wall) to the catalyst in an inner chamber has shown that in the optimum case the amount of heat transferred from the external jacket to the catalyst trays is equal to that amount which could be radiated from the jacket to a parallel wall having a surface equal to the surface of the jacket and having a temperature equal to the temperature of the catalyst. This fact, resulting from the laws of radiant-heat-transfer, constitutes a limitation on the efficiency of the apparatus described in the earlier part of the application as compared with an apparatus where the reaction space has an annular form and is heated from the interior.

In Figure 2 a diagrammatic form of the preferred apparatus is shown. The inner jacket **9** is heated from the interior by a single flame **10** which is easy to handle and regulate. This flame can be obtained by means of one or many burners **11**, depending upon the size of the apparatus. The apparatus has an outside wall **12** made, e. g., from ordinary sheet-iron and masonry work of ceramic insulating material. The catalyst is placed in layers or trays **13** in the annular reaction space between the inner jacket **9** and the outer wall of the apparatus **12**. The catalyst is heated by the radiation of the inner jacket, which radiates either directly on the catalyst and/or by reflexion from, e. g., the outer wall. It can be noticed that the catalyst layer is in this case very thin and large empty spaces provide ample opportunity for radiation from or through the heated wall **9** to all parts of the surface of the catalyst layer.

Reaction gases leave the reaction space by conduit **14** and in a heat-exchanger **15** serve to preheat gases for the reaction, which preheated gases then enter the reaction space by conduit **16**. Any gas-tight device, e. g., liquid seal or bellows, etc., can be used to take care of expansions or contractions of the radiating jacket **9**.

In this preferred shape of apparatus as shown a more intense heat transfer to the catalyst is attained by designing the outer wall and/or its heat insulating cover to reflect the major part of the heat back on the catalyst. In this way either higher temperature of the catalyst can be obtained or more gas per reaction-volume can be passed. By increase of the outer radius of the apparatus, while simultaneously maintaining the size of the radiating surface of the inner jacket, the catalyst can be advantageously distributed in very thin layers, which assists in achieving uniform heating of its mass.

In case of a gas fuel it is advantageous to use visible flame enabling a more uniform distribution of the temperature on the whole length of the apparatus.

As the heat transfer of the apparatus of my invention is based on radiation it is especially suitable for endo-thermic reactions occurring at elevated temperatures, e.g., reactions of dehydrogenation or the conversion of hydrocarbons and steam into water-gas mixtures. Natural gas or refinery cracking gases can be converted with steam into water-gas of high hydrogen-content. Also other gases like blue gas can have their methane component converted to a large extent to carbon-monoxide and hydrogen. Any catalyst or combinations thereof of one or more catalysts with promoters and carriers suitable for the contemplated reaction can be used in this apparatus, e.g., iron, nickel, cobalt, copper, in metallic form or oxides or natural ores or salts, alumina, compounds of chromium, thorium, silicium, cerium, vanadium, tungsten, zinc, tin, lead, cadmium, manganese, molybdenum, sodium, potassium and boron. They can be used by themselves or deposited or intimately mixed with carriers of acid, alkaline or neutral character, such as siliceous materials, porcelain, kieselguhr, pumice, silicagel, natural or artificial zeolites, alumina, bauxite, magnesia, slag, calcium oxide or silicate, barium carbonate, active carbon and the like.

The efficiency of the catalyst is very high, especially when used in very thin layers; there-

fore, even expensive catalysts can be used such as, e.g., silver, platinum, palladium, rhodium, gold, beryllium and rhenium.

As the catalyst is maintained in a thin layer in a rather constant temperature, the requirements as to its mechanical strength can be neglected in favor of its activity; therefore, highly activated catalysts can be useful though they might have only a low mechanical resistance.

Most of the catalysts referred to above can be used either in the water-gas reaction or in the reactions of dehydrogenation. For example, ethane, propane, butanes and similar hydrocarbons can be converted either alone or with additions of steam or carbon dioxide into mixtures containing large proportions of unsaturated hydrocarbons, which subsequently can be useful in polymerizing them into liquid motor-fuels. In case of reactions producing deposits of carbon on the trays or causing a poisoning of the catalyst, the operation can be periodically interrupted and steam or air or their mixtures can be passed to revivify the catalyst, and in this operation radiation from the exo-thermic zone on the catalyst layer can be used to prevent overheating which would impair the catalytic activity.

Figure 3 shows diagrammatically an example of a large unit of the preferred type for conversion of natural gas with steam into water-gas. This unit is composed of two cylindrical apparatus, each about 30 feet high and 10 feet in diameter producing about three million cubic feet of water gas daily. Relatively large diameter is desirable since the capacity increases more than proportionally to the diameter. In the annular reaction spaces 17 granular iron ore is used as a catalyst and is distributed in thin layers on trays. The annular reaction space is divided by perforated trays into annular compartments averaging about 3¼ inches high and 6 inches wide. The catalyst layers are about ¼ inch thick, thus leaving an empty space about 3 inches high and 6 inches wide for distribution of the radiant heat. Natural gas and steam enter the reaction spaces through conduits 18 in regulated amounts and are forced through the catalyst layers, where the reaction takes place. Water-gas leaves the reaction chambers through conduits 19. The heat necessary for the reaction is furnished by radiation from or through the inner jackets 20 of cylindrical form built of heat-resistant steel and suspended from the top (mechanical details of suspension, not shown, may be according to accepted engineering practice).

Jackets 20 are heated by combustion gases of gas burners 21 to approximately 1000°C. Though the temperatures of the jackets might not be entirely uniform, some degree of auto-regulation of the temperature of the catalyst, due to the different rates of endo-thermic reaction at different temperature levels, may be noticeable: Thus overheating at any point may result in increased reaction velocity, which, due to its endothermic nature, will absorb more heat from the wall.

Additional burners 22 are provided in the channel 23 through which combustion gases pass from the first generator into the second. After passing the second generator, the combustion gases serve to superheat the steam or other feed gases in the preheater 24 and to generate steam in the boiler 25. The heat from the jackets 20 radiates either directly on the catalyst or by reflexion from the insulated outer wall 26. The temperature of the catalyst in this specific example is approximately 800°C. For the temperature of the jacket of 1000°C and of the catalyst of 800°C the radiant heat transfer is of the order of 260 $Cal/m^2 \cdot 1°C \cdot h$. The flame temperature within the jacket may be of the order of 1100–1500°C.

The expansions and contractions of the jackets can regulate automatically the amount of fuel and consequently the temperature of the process.

In accordance with my invention, apparatus can also be constructed capable of operating at various temperatures, e.g. 300°C to 1200°C and of resisting pressures of various intensities, and the various reactions, e.g. the dehydrogenation process, can be conducted, if advantageous or necessary, under such temperatures and pressures. Among the known means of reinforcing or of increasing the resistance of the walls against pressures, a suitable method is the welding of the catalyst trays to the heating jacket.

It will be understood that the various apparatus and processes described are merely representative examples and that this invention is not to be limited to the specific details shown and described. It will be observed that certain features and sub-combinations are of utility and may be employed without reference to other features and sub-combinations. This is contemplated by and is within the scope of the invention.

ROMAN WITKIEWICZ.

[illegible]

PUBLISHED

APRIL 27, 1943.

BY A. P. C.

R. WITKIEWICZ

APPARATUS FOR PERFORMING ENDO-THERMIC CATALYTIC REACTIONS IN THE GAS-PHASE

Filed March 30, 1939

Serial No. 264,995

2 Sheets-Sheet 1

Fig. 1.

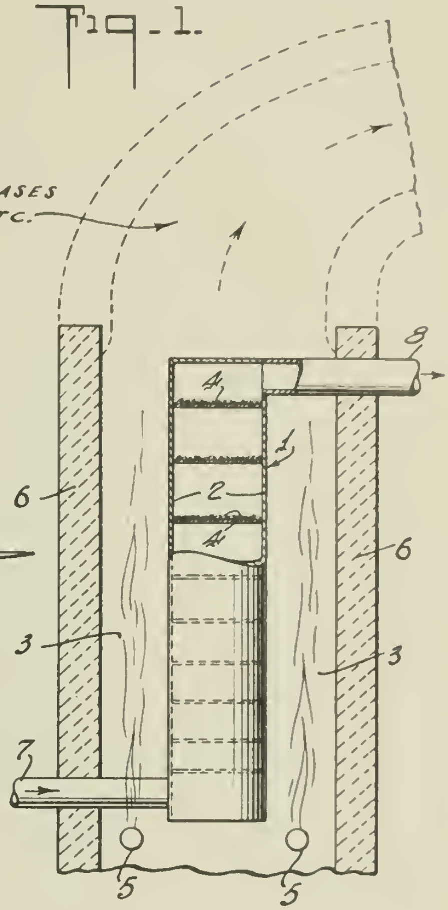
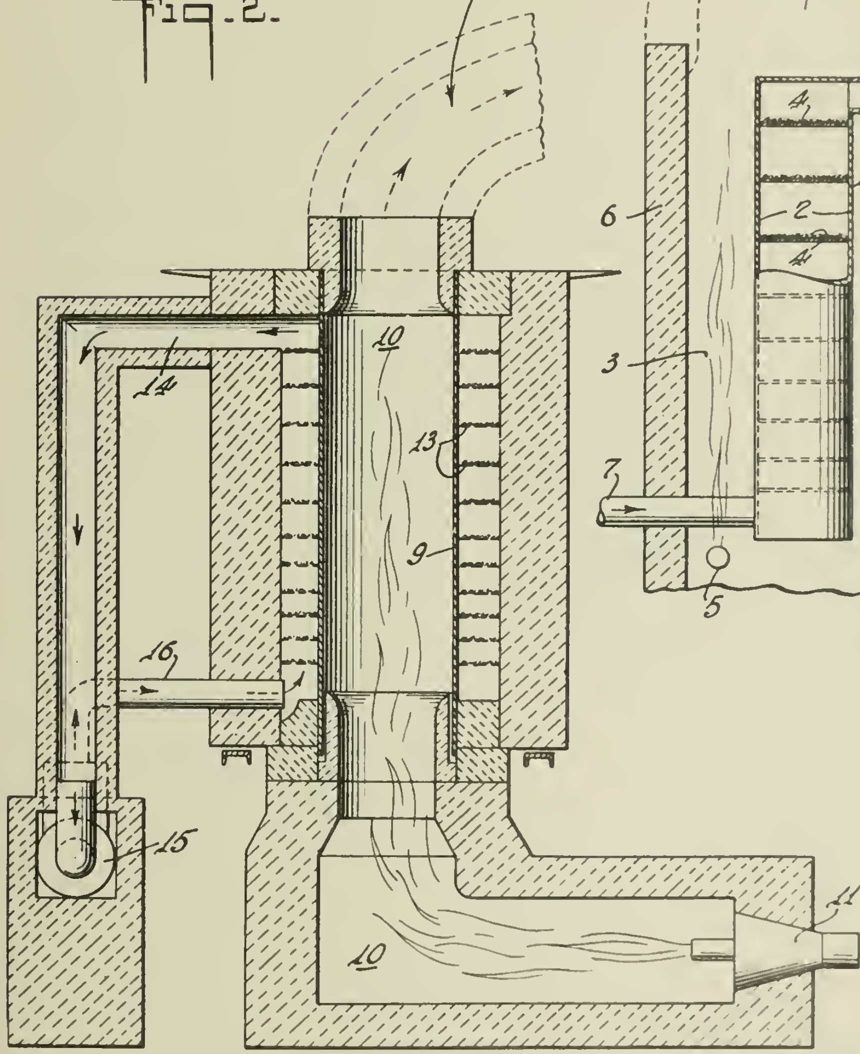


Fig. 2.



INVENTOR

Roman Witkiewicz

BY

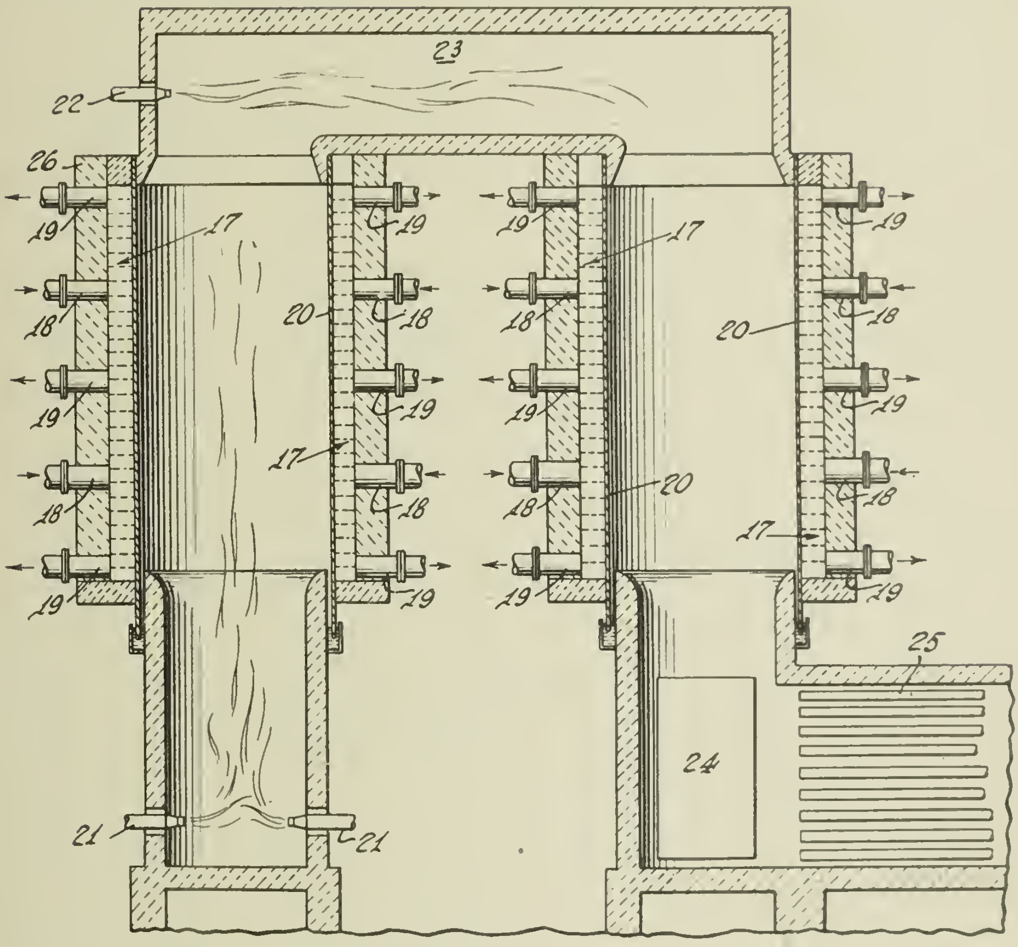
ATTORNEY

PUBLISHED
APRIL 27, 1943.
BY A. P. C.

R. WITKIEWICZ
APPARATUS FOR PERFORMING ENDO-THERMIC CATALYTIC REACTIONS IN THE GAS-PHASE
Filed March 30, 1939

Serial No.
264,995
2 Sheets-Sheet 2

Fig-3-



INVENTOR
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ATTORNEY

Published Apr. 27, 1943

Serial No. 268,117

ALIEN PROPERTY CUSTODIAN

ARTICLES MOLDED FROM SYNTHETIC RESIN

Walter Engel, Nice, France; vested in the Alien Property Custodian

No Drawing. Application April 15, 1939

This invention relates to improvements in articles moulded from synthetic plastic and to an improved process for manufacturing such articles.

Articles made of synthetic plastic which are porous superficially are already known but in the known articles the pores either do not extend through the whole mass of the article or else the article does not possess sufficient mechanical strength to make it available for various practical purposes.

According to my invention a process for the manufacture of porous articles from synthetic plastics consists in moulding an article under pressure and heat from a mixture of synthetic plastic and particles of metal or of metal and graphite which render the moulding conductive to heat and/or electricity, together with additional matter which contracts or disappears during the moulding or heating process or which is dissolved out subsequently to leave fine capillary canals extending throughout the moulding; or the metal particles or metal and graphite particles may simply be mixed with synthetic plastic and the mixture moulded under pressure and heated to harden the synthetic plastic which contracts and leaves fine capillary canals, or the metal or metal and graphite particles may be mixed with synthetic plastic and finely divided particles of a soluble substance which, after the moulding has been formed under pressure and heat, is dissolved out of the moulding by means of a suitable solvent to leave fine capillary canals in the moulding.

Such mouldings containing metal particles or metal and graphite particles are particularly suitable for use as bearings, filters, commutators for high voltage electrical machines, as the pores or canals in the moulding will receive and retain lubricant while the metal or metal and graphite particles will conduct electricity and at the same time serve for dissipating any heat generated.

In one method of carrying out my invention an intimate mixture of synthetic resin moulding powder, finely divided metallic particles, and finely divided particles capable of being dissolved out subsequently is moulded under heat and pressure to the desired shape.

The surface skin of the moulding, the so-called pressing skin, is then removed in any convenient manner, as for example by abrasion with a sand blast, and the soluble particles are dissolved out of the moulding by treating it with an appropriate solvent. The dissolving out of these particles leaves the moulding pierced by a network of fine capillary canals intercommunicating with each other.

The soluble particles may be of a salt such as sodium chloride which is water-soluble so that they can be dissolved out by treating the moulding with water, or they may be of a metal such as zinc which can be dissolved out by treating the moulding with an acid which does not attack the particles of other metal which are to remain in the moulding.

The soluble material mixed with the moulding powder and metallic particles from the canals in the moulding may be of such a nature as to effect catalytically the hardening of the synthetic resin. Many metal salts such as sodium carbonate have this property.

In another method of producing mouldings in accordance with my invention artificial resin grains are formed from a hardenable artificial resin, preferably from a phenol-formaldehyde condensation product, by its transformation into the so-called C state, and the grains are brought by grinding and sieving to a size suitable to give the desired permeability to the moulding. These grains are then mixed with metallic particles and with a resin in the A or B state. This mixture is pressed in moulds and heated or dried at a temperature of from 100° to 200° Cent., the resin which is added in the A or B state serving as a binder which during the heating or drying contracts if hardenable or disappears if not hardenable and leaves the moulding with a network fine capillary canals. If the added resin disappears in the heating or drying of the moulding the temperature must be raised to a degree sufficient to cause the particles of hardened resin to adhere together through partial fusion of their meeting surfaces. For some purposes the grains of hardened artificial resin may be replaced wholly by metallic particles and the added resin forming the binder is hardenable so that the product is a moulding made up of metallic particles held together by the binder which has contracted to leave fine canals extending throughout the moulding.

Instead of using hardened grains of artificial resin in the C state, a hardenable artificial resin in the A or B state absorbed by fillers such as wood flour, asbestos flour, or any other fibrous material may be used, the masses so obtained being ground and sieved to the required dimensions.

WALTER ENGEL.

[illegible]

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PUBLISHED
APRIL 27, 1943.
BY A. P. C.

W. ENGEL
ARTICLES MOLDED FROM SYNTHETIC RESIN
Filed April 15, 1939

Serial No.
268,117

Fig. 1

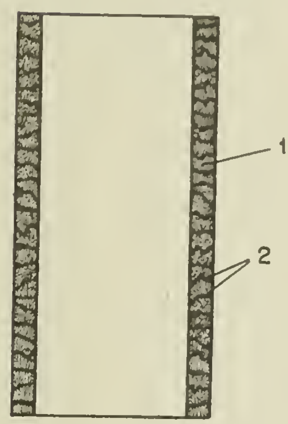
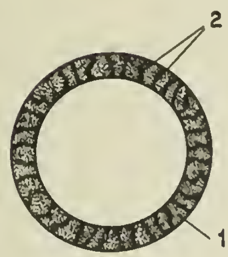


Fig. 2



INVENTOR
Walter Engel
BY *H. B. Willson & Co*
ATTORNEYS

Published Apr. 27, 1943

Serial No. 268,616

ALIEN PROPERTY CUSTODIAN

HEATING OVENS, PARTICULARLY THOSE FOR HARDENING GLASS PLATES

Felix Vranken, Jemeppe-sur-Sambre, Belgium; vested in the Alien Property Custodian

Application filed April 18, 1939

The invention relates to heating ovens and concerns more particularly, amongst such ovens those used for heating glass plates for hardening purposes.

In heating ovens as actually used, in which the articles, and particularly the glass plates, to be heated, are introduced at one end and delivered at the opposite end of the oven, these articles are generally supported by means of a suspension device including a movable carriage moving on a fixed supporting track.

This track, as well as the supporting carriage pass through the oven and are thus subjected to high temperatures, which are not favorable to the good functioning of the device and the maintenance of the parts. These actions are so much the more marked that in the upper portion of the oven, where the supporting track is located, there is a heat accumulation due to the fact that the top of the oven is closed.

The main purpose of the invention is to avoid these drawbacks.

To this end the invention mainly consists to arrange the supporting track outside the oven thus ensuring largely lower working temperatures for the members of the suspension device and, together with a correct operation, a practically unlimited life of these members.

The invention also consists in causing the members connecting the sustained articles, and particularly the glass plates, to the suspension device to enter the oven through a split or slot provided in a wall, and particularly the top wall of the oven, and which may further be adjusted as desired.

A further advantage of this arrangement lies in that an accumulation of heat in the upper portion of the oven is avoided, the adjustment of the split or slot enabling to a certain extent the temperature to be adjusted in the said upper portion of the oven.

And in order that the manner in which the characteristic arrangements of the invention may be practically carried out, to be understood, such arrangements will be described hereafter with more detail in their application to the ovens for use in hardening glass plates and with reference to the annexed drawing showing diagrammatically:

Fig. 1 a side elevation view of a heating oven;

Fig. 2 a corresponding end elevation view;

Fig. 3 a top plan view of the oven.

Referring to the drawing, 1 designates an oven which may be of any desired type, for example heated by means of electrical resistances, provided at its ends with doors 2 and 3 of any convenient construction, and for example so arranged as to open and close by tilting laterally on hinges or the like or by vertical or lateral sliding, the tilting or sliding movement being ensured by means of devices actuated either automatically or manually.

Above the oven there is provided a transporting track formed by means of a pair of rails or other iron sections 4 suitably suspended for example by means of brackets 5.

On this track move supporting carriages 6, provided with members 7 for supporting the glass plates 8, these members including rods or the like associated with tongs of any known type in the selected example.

The suspension members 7 enter the oven through a split or slot 9 formed in its top wall and opening to the outside on the outer surfaces of the end walls of the oven so as to enable the glass plates to be introduced into and removed from the oven.

In principle, this split or slot 9 may receive a width which is only somewhat greater than the thickness (or width) of the members 7, so as to enable the passage thereof with the necessary working clearance, but according to the invention the width of this split or slot is made more important.

As above indicated it has been observed that in ovens closed at the top heat accumulates in the upper portion, which may become detrimental to the uniform heating of the articles, particularly the glass plates, in the oven.

Through the split or slot 9 giving passage to the suspension members 7, passage is afforded, from the inside to the outside, for a portion of the heat of the oven, and this escape of heat has the result to reduce or to remove the said heat accumulation.

By suitably proportioning the width of the split or slot 9 and the thickness (or width) of the members 7, any desired compensation may be obtained.

However, it is preferable to have the split or slot 9 made wider than necessary for the passage of the members 7, so as to dispose from a discharge which in any case will be sufficient and which may then be adjusted by providing on the top surface of the oven and as illustrated in dotted lines in the drawing, movable members 10 such as plates made of metal or refractory material, which may be moved as desired towards or away from each other so as to reduce or increase the value of the heat escape.

Further to the advantage of permitting the escape and the adjustment of the excess of heat in the upper portion of the oven, the invention also avoids a complicated arrangement of the closing doors **2** and **3** which in the actual constructions with internal supporting track generally used includes not only a laterally tiltable opening member but also a flap hinged on this member and adapted to recover, in the closed position of the door, the part of the oven opening which is located on the other side of the transporting track relatively to the hinges.

The advantage lies not only in a more simple construction of the doors, but also in the time required for the operation thereof, which is already important for the regularity of the heating of the oven but yet more important for the good execution of the hardening operation.

Although one single method of carrying out the invention has been described in detail, it is to be understood that the invention is not limited to this embodiment but to the contrary that it includes the alternatives and the modifications; also the invention is not limited to heating ovens for glass plates to be hardened but is generally applicable to the heating of articles of various description.

FÉLIX VRANKEN.

PUBLISHED
APRIL 27, 1943.
BY A. P. C.

F. VRANKEN
HEATING OVENS, PARTICULARLY THOSE
FOR HARDENING GLASS PLATES
Filed April 18, 1939

Serial No.
268,616

FIG. 1

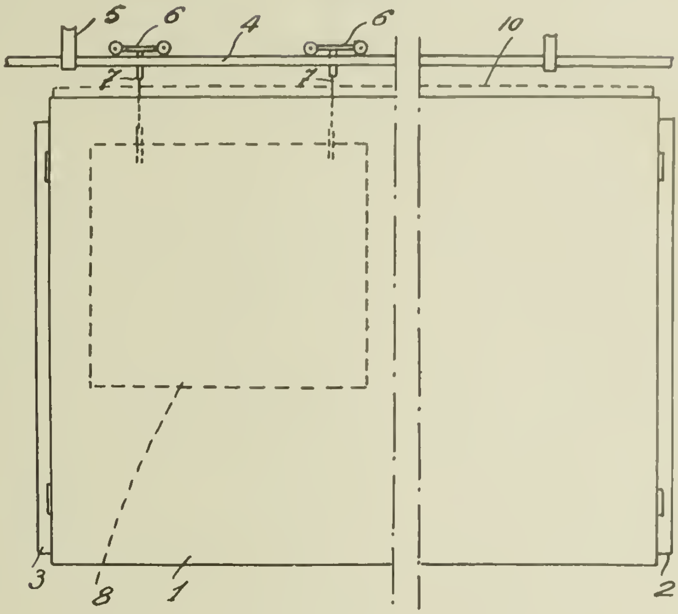
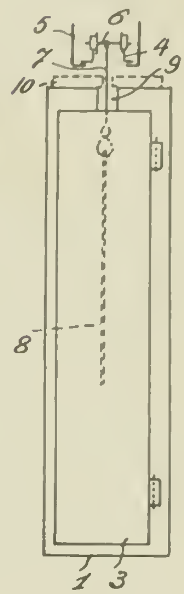


FIG. 2



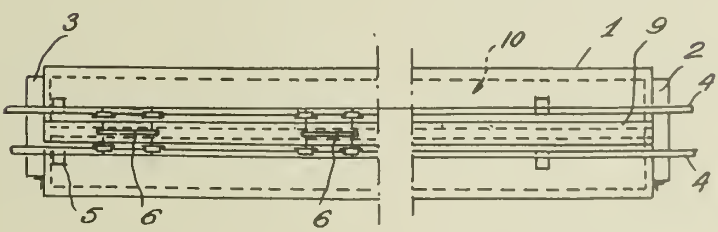


FIG. 3.

Inventor,
F. Vranken

By: Glascock, Downing & Seebold
Attys.

Published Apr. 27, 1943

Serial No. 270,689

ALIEN PROPERTY CUSTODIAN

PROCESS OF MANUFACTURING ALKALINE SILICATES IN POWDER FORM

David Kusman, Brussels, Belgium; vested in the Alien Property Custodian

No Drawing. Application filed April 28, 1939

My present invention relates to the manufacture of alkaline silicates and its object is to make it possible to obtain such silicates, with various silica to alkali ratios, in form of powders of crystalline appearance, stable, and adapted to dissolve completely in water.

As is known, alkaline silicates are found on the market in form of syrupy liquids obtained by dissolving, under vapor pressure, vitreous silicates produces by fusion in a furnace of mixtures of sand and alkali in varying proportions. The liquid sodium silicate available on the market usually has a content of 36% sodium silicate, a specific weight of 38° to 40°Bé and a silica to soda ratio varying from 1,62 to3,42.

In view of the inconveniences which result naturally from the liquid state of these products, i.e. relatively low concentration, high cost of packing and transportation, it has been proposed to prepare them in form of powders soluble in water at ordinary temperature and pressure, particularly for the preparation of so-called detergent powders.

Some of the process first proposed to this end were based on hydration of the vitreous silicate and others on the drying of the liquid silicate finely pulverised in a hot current of air. The silicates thus prepared, however, usually had at least one of the following drawbacks: tendency to agglomeration, hence lack of stability; low solubility in water, especially with products rich in silica; impossibility of obtaining a concentrated solution.

In order to avoid these inconveniences a process was proposed, which made use of the crystallisation in bulk of a solution of silicate of sodium previously brought down to predetermined silica, soda and water contents by additions of caustic soda to the commercial sodium silicate and subsequent evaporation. This crystallising process, however, allows of obtaining only the metasilicate (i.e. the salt with a silica to alcali ratio=1) but it is not suitable for the production of silicates with high silica contents, more particularly the trisilicate ($Na_2O.3SiO_2$) which has marked colloidal properties. Now it is particularly desirable to obtain silicates with high silica contents, in the form of a soluble powder, as they have a very marked detergent action.

The process according to the present invention makes it possible to obtain, in the form of a stable and soluble powder, silicates with high silica contents, that is having a silica: alkali ratio equal to 2 or greater than 2. It is based on the property of solutions of silicates with relatively high silica contents, of forming precipitates in presence of certain organic or even certain inorganic bodies. This property, until now, has not been used commercially, because, even after draining, the precipitates still retain a substantial amount of water and of precipitating agent so that when exposed to the atmosphere or when heated they again become gelatinous.

In accordance with my present invention, after having treated by a coagulating agent a solution of alkaline silicate, for example a commercial liquid silicate, I subject the coagulated mass to a treatment that causes the elimination of the water in presence of the coagulating agent employed. To that end I may subject the mass to pressure or let it stand while opposing the evaporation of the coagulating agent, which usually is more volatile than water.

After the liquid has separated, the mass forms a hard and brittle cake which I reduce to powder, and said powder then is dried under continuous stirring at a temperature not exceeding 45°C. After a short time, the grains take the appearance of small hard crystals, of uniform size and transparent, having a composition corresponding to that of the silicate or silicate mixture used as a starting material, which composition may reach or exceed a silica:alkali ratio=3. As to the water content, it may vary according to the duration of the drying operation.

A great advantage of the silicates obtained by this process is that they dissolve, without stirring, in water, even in cold water.

As coagulating agent I may use an alcohol, an acetone or other suitable organic compounds, in small amount, or also some inorganic compounds such as ammonia.

By way of example, a method of preparing sodium trisilicate now will be described:

To 1000 gr. of commercial liquid so-called neutral silicate having a silica:soda ratio about 3 and a specific weight of 39°Bé, I add 100 cubic centimeters of methyl alcohol while stirring until I obtain a rather compact mass similar to white cheese. This mass is immediately subjected to pressure in a press with a perforated basket adapted to produce a pressure of about 30 atmospheres and collect the liquid expressed. This liquid which contains the larger portion of the alcohol used, is subjected to distillation in order to recuperate the alcohol.

The product withdrawn from the press is a hard and brittle cake which is not sticky and can be easily reduced to powder form. This powder is dried under continuous agitation for

about 2 to 3 hours at a temperature not exceeding 45°C.

Instead of subjecting the mass to pressure, I may place it on a porous surface, for example in a bag of woven fabric, which is enclosed for 24 hours within a closed receptacle having a capacity only a little greater than that of the bag in order to prevent evaporation of the alcohol.

Under these conditions the coagulum contracts, expulses the impregnating liquid and forms a hard and brittle cake, while the liquid collects at the bottom of the receptacle. As above the cake is reduced to a powder and said powder is dried.

In both cases, after drying the product has a crystalline appearance; it is dry and fluid; on being analysed it is found to answer the formula: $Na_2O.3SiO_2 \pm 6H_2O$. This product may be partly dehydrated by slow heating at a temperature comprised between 45° and 100°C.

The powdered silicates prepared in the manner described keep a crystalline, dry and fluid appearance even after a few days' standing in the atmosphere, and they dissolve easily in water, thus permitting the preparation of highly concentrated solutions, even in cold water. Said products having a high silica content, I may, in order to obtain any desired silica:alkali ratio, mix them with caustic soda, either in dry powder form, when using them in the dissolving bath.

DAVID KUSMAN.

Published Apr. 27, 1943

Serial No. 270,788

ALIEN PROPERTY CUSTODIAN

INSTRUCTIVE AND DEMONSTRATION APPARATUS OR TOY FOR THE CONSTRUCTION OF VARIOUS ELECTRIC MACHINES AND DEVICES

Maurice Latour, La Varenne-Saint-Hilaire, France; vested in the Alien Property Custodian

Application filed April 29, 1939

The present invention has for object an instructive and demonstration apparatus or toy for the construction of various electric machines and devices.

Toys have already been proposed comprising independent mechanical and electrical members which the young constructor assembles according to his imagination, or according to indications supplied by the tables accompanying the box containing the various members. In known demonstration toys or apparatus, the attention is first of all arrested by difficulties of mechanical order. In fact, the assemblage of the various parts, particularly when centering is necessary, is extremely delicate and great accuracy cannot be attained. In these conditions, even with correct electric assemblage, the machines constructed do not work or work badly, this removing all attractiveness and rapidly discouraging the young constructor.

The problem which the Applicant has solved consists in allowing the construction of various electric machines and devices, by means of simple mechanical elements and elementary electric members, whilst practically eliminating the main mechanical difficulties and leaving apparent but the difficulties of electrical order.

One of the main mechanical difficulties, particularly in the case of rotating machines, resides in the centering of the rotors relatively to the stators.

An important feature of the present invention consists in materializing a longitudinal axis and several radial axes at right angles to the longitudinal axis and uniformly distributed about the latter, by means of a member about which are mounted the various outer parts, said member being then removed for allowing the assemblage of the inner apparatus which is thus perfectly centered relatively to the outer unit.

In a form of construction, the removable assembling member materializes three axes at right angles to each other and has, for that purpose, the shape of a Greek cross or a St. Andrew's cross the ends of which are bent down on one and the same side, the central part being perforated as well as the bent down ends for materializing the three above mentioned axes.

The removable assembling member is combined with external stays allowing to mount the fixed unit at a suitable distance from said member.

The main independent elements which, after assemblage, form the fixed unit of the machine or of the assembly, are constituted by rectilinear, arcuate, right-angle, V, or other suitably shaped plates, the ends of which are provided with notches or oblong and longitudinal holes.

Some of these members are made of brass, aluminium or the like and are used for different assemblages.

Members are also available which allow of constituting interchangeable pole-shoes of variable widths and curvatures.

The invention also extends to the particular construction of brushes and their adjusting devices as well as the construction of rotors and collectors.

The invention also includes other particular points which will appear in the following text with reference to the accompanying drawing, given by way of example only, in which:

Figs. 1 to 8 are perspective views showing various embodiments of assemblages utilising a removable Greek cross.

Fig. 9 is a perspective view of an assemblage with two windings.

Fig. 10 is a perspective view of a rotor.

Fig. 11 is a perspective view of another rotor.

Fig. 12 is a perspective view of an assemblage comprising a perfectly centered rotor and stator.

Fig. 13 is a perspective view of another embodiment of a rotor.

Fig. 14 is an elevation of the assemblage of adjustable brushes.

Fig. 15 is a perspective view showing the constitution and the assemblage of a collector.

Fig. 16 is a perspective view of an embodiment of a rotating contact.

Fig. 17 is a perspective view of an assembling member.

Fig. 18 is a perspective view of an assemblage in the case when use is made of a member made of brass or the like.

Figs. 19 and 20 are perspective views of two interchangeable pole-shoes.

In the various embodiments, illustrated by way of example only, use is made, for assembling the outer unit, of a member 1 in the shape of a cross (Greek cross for instance) the ends of the branches 2 of which are bent down at right angles on one and the same side, as more particularly shown in Figs. 1 to 8.

The member 1 is axially perforated at 3 for materializing an axis 4 and the bent down ends 2 are also perforated for materializing two axes 5 and 6. These axes 5 and 6, located in one and the same plane, are at right angles to each other and to the axis 4. By means of tubular stays 7, secured on the lugs 2 by screws 8, the axes 5 and 6 are materialized and the distance at which the

outer unit is to be mounted relatively to the axis 4 is practically determined.

The stays 7 comprise, at their outer ends, shoes or seating members 9 facilitating the assemblage of arcuate plates 10 the ends of which are provided with longitudinal oblong notches 11. These oblong notches can be replaced by oblong holes. The arcuate plates 10 are secured to the corresponding stays by screws 12 and they are connected by identical intermediate plates secured by bolts 14 and nuts 15. An outer unit is thus obtained which is perfectly centered relatively to the axis 4.

The assemblage previously indicated is more particularly illustrated in fig. 1. In order to effect the placing in position of the bearings or supports of the rotor according to the axis 4, the two vertical stays extending according to the axis 5 are removed, and member 1 is caused to rotate through 90 degrees about the axis 6 to bring it to the position shown in fig. 2. For correctly placing said member 1 in its new position, the rod 4*a* is mounted in the central perforation 3 of member 1, said rod being momentarily held stationary at its ends on the outer unit according to the primitive axis 5, through the medium of bolts 18. The perforations provided in the lugs 2, which perforations materialize the axis 5 in fig. 1, are arranged according to the axis 4 in fig. 2. The screws of the axis 6 are then locked for holding the member 1 stationary in position and the rod 4*a* is dismantled.

Reference will now be made to fig. 3 in which the axis 4 is again materialized by a rod 4^b allowing the correct assemblage of one of the bearings of the rotor. For that purpose, use is made of bent plates 19 and rectilinear plates 20, these plates being provided at their ends with longitudinal oblong notches or holes as previously indicated for plates 10.

As illustrated in fig. 4, the assemblage of the other bearing is then effected, in a similar manner to that previously indicated with reference to fig. 3.

The outer unit being perfectly centered relatively to the longitudinal axis 4, the member 1 is dismantled for allowing, in the first place, the various electric elements to be mounted on the fixed framework, and then the mounting of the rotor.

The mechanical assemblage of the various elements is effected without any difficulty and with very great accuracy, and the young constructor can give all his attention to the placing in position of the electric elements and to the execution of the electric connections. If the machine constructed fails to work, the mistakes in the assemblage do not arise from the mechanical part, but solely from the electric part.

For facilitating the assemblage of the outer unit, as particularly indicated in fig. 1, between the outer platens or seating members 9 rigid with the stays 7 and the corresponding plates 10, can be interposed elements 23 more particularly illustrated in fig. 17. These elements which are of square shape, have two opposite sides 23^a bent at right angles, in one direction and two other opposite sides 23^b bent in the reverse direction. Said elements 23 avoid an eccentric assemblage of the outer unit relatively to the axis 4. The elements 23 are also used for assembling two members at right angles to each other. Thus, in figs. 1 to 4, said elements 23 allow of correctly assembling the feet 25 forming a base.

Figs. 5 to 8, which correspond, as regards the method of procedure, to figs. 1 to 4, illustrate the assemblage of a fixed outer unit constituted by two rectangular frames 30 and 31 at right angles to each other. The frames 30 and 31 are constituted by plates 32 connected at their ends by bent members 33, said members and said plates being provided with longitudinal oblong notches or holes. Moreover, for maintaining the alignment of the various members, use can be made of elements such as 23 (fig. 17) or similar parts which comprise only lifted opposite edges such as 23^a, the edges 23^b being done away with.

Fig. 9 substantially corresponds to fig. 8 and shows the assemblage of coils 38 correctly arranged before assembling the member 1.

Fig. 10 diagrammatically illustrates the assemblage of a rotor on a spindle 40. Use is made of a U-shaped support 41 which is locked in position on the spindle 40 by means of a slotted tubular bolt 42 and nuts 43 having a frustum-shaped pitch. The branches of the support 41 are provided with longitudinal oblong notches or holes for securing in position, by means of screws 45 and 46, the stays 47 and members 48 and 49.

Fig. 11 illustrates another embodiment of a rotor in the case of rotating inductors. In this embodiment, the support 41 has three lateral tongues arranged according to the sides of an equilateral triangle and which are provided with longitudinal oblong notches for securing the various members in position by means of screws 45 and 46.

Fig. 12 shows a machine constructed from the assemblage of fig. 5 and which comprises a rotor constructed in accordance with fig. 11. The assemblage of the brushes 50 will be more particularly described with reference to fig. 14 and that of the collector 51 will be indicated when describing figs. 15 and 16.

Fig. 13 illustrates, in perspective view, a modified embodiment of a rotor in which use is made of supports 33^a constituted by right-angle members 33 employed in the case of Figs. 5 to 8. These supports 33, which are provided, at their ends with longitudinal oblong notches, are locked on the spindle 40 as indicated concerning Fig. 10 and the members 49 are mounted by means of bolts and nuts.

Fig. 14 illustrates an assemblage of two brushes 50 the ends of which are arranged on either side of a collector 51, said ends partially conforming to the cylindrical shape of said collector. The outer ends of the brushes 50 are mounted and held stationary on spindles 55 rigid with a member frictionally mounted on the spindle 40 owing to a resilient washer 57, a toothed wheel 58 being rigid with member 56. A small toothed wheel 59, meshing with the wheel 58, is fast on an operating knob 60 allowing to adjust, at will, the position of the brushes on the collector 51.

Fig. 15 illustrates, by way of example only, an embodiment of a collector constructed by means of independent elements. Each collector is constituted by two lateral cheek members 61 made of insulating material and axially perforated for the passage of a tubular bolt 62 in which engages the spindle 40 of the rotor, this tubular bolt itself engages in at least one tubular stay 63 holding the cheek members 61 at a suitable distance apart. Said check members are provided with arcuate ports 64 arranged substantially according to one and the same circumference and in which engage the ends 65 of blades 66. The width of said blades 66 is greater than that of the ends 65 so that after juxtaposing the various

blades, which are held in position by cheek members **61**, a cylindrical collector is obtained.

In a modification illustrated in Fig. 16, the blades are replaced by a strip **70** curved according to a cylinder and which laterally comprises tongues **71** engaging in some of the ports **64** of the cheek members **61**; thus a rotating contact is obtained.

Fig. 18 illustrates an assemblage in which use is made of magnets **75**. For ensuring sufficient rigidity of this assemblage, whilst avoiding a magnetic short-circuit, it is necessary to provide a unit **76** constituted by members **33**[a] made of brass provided with oblong holes or notches for allowing the same to be secured in position as already indicated. In this assemblage has also been illustrated the member **1** utilized for centering the various parts.

Figs. 19 and 20 show the assemblage of variable pole-shoes. In the example of Fig. 19, use is made of a member **80** and a U-shaped element **81** the branches of which are divergent. In the example of Fig. 20, the branches of element **81** are much longer for constituting the pole-shoes.

It will be noted that the double or triple armatures can be replaced, either by a flat ring armature or by a smooth Siemens drum armature, or finally by a slotted drum armature.

The assembling member **1** allows of obtaining different diameters by interposing between the cores of the inductors and the bent ends **2** of said member **1**, wedges of variable thicknesses, one of said wedges being constant in view of compensating the pole-shoes which have variable widths and curvatures in function of the respective diameters of the rotors and stators.

By means of the different arcuate, rectilinear, V-shaped, right-angle or other plates, each end of which is provided with a longitudinal oblong notch, it is possible to construct numerous electric machines and various electric mountings, as different electric members accompany the box containing said plates.

It will be noted, as indicated in the preamble to the present application, that the main mechanical difficulties are eliminated, the mechanical assemblage necessitating no particular attention, the only difficulties encountered being solely of electrical order.

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PUBLISHED
APRIL 27, 1943.
BY A. P. C.

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INSTRUCTIVE AND DEMONSTRATION APPARATUS OR TOY FOR THE CONSTRUCTION OF VARIOUS ELECTRIC MACHINES AND DEVICES
Filed April 29, 1939

Serial No.
270,788
6 Sheets-Sheet 1

Fig. 1.

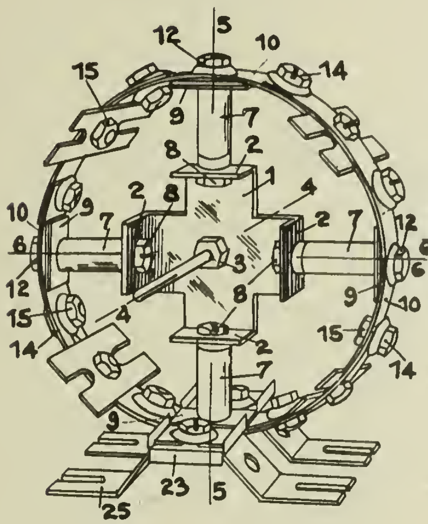


Fig. 2.

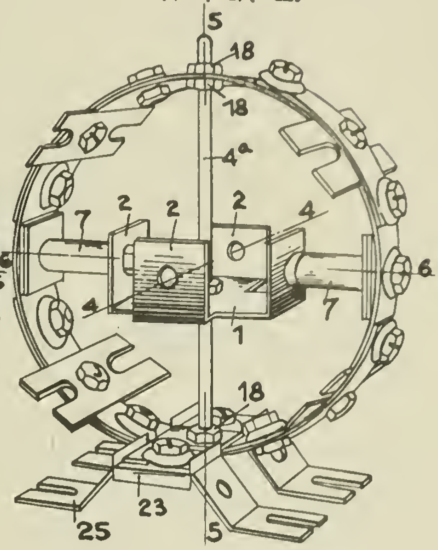


Fig. 3.

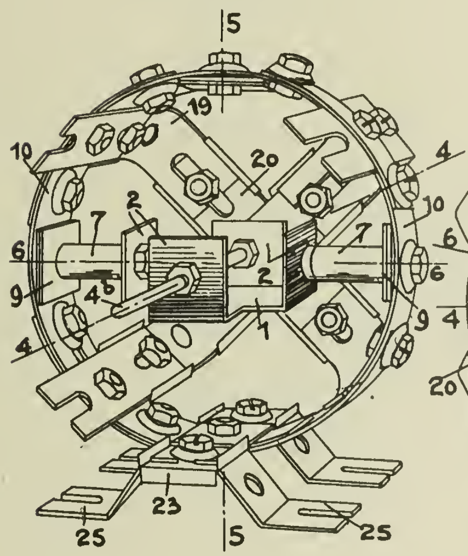
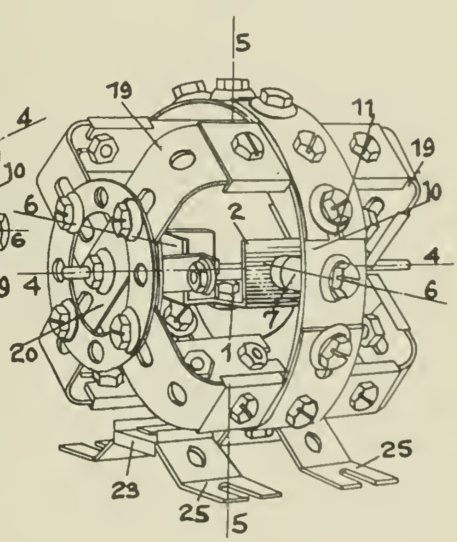


Fig. 4



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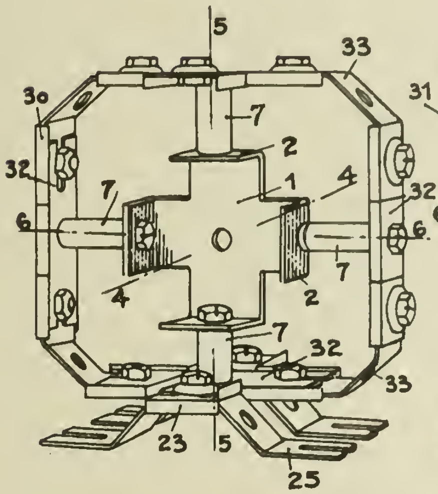
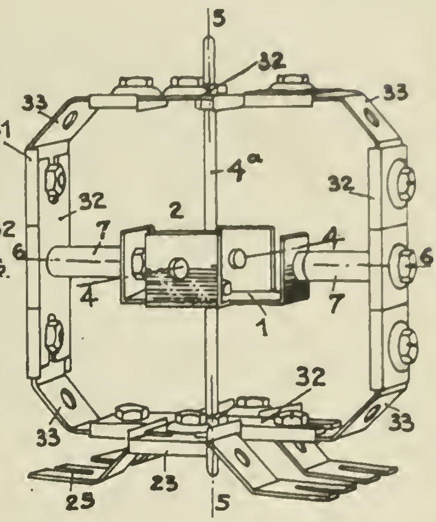
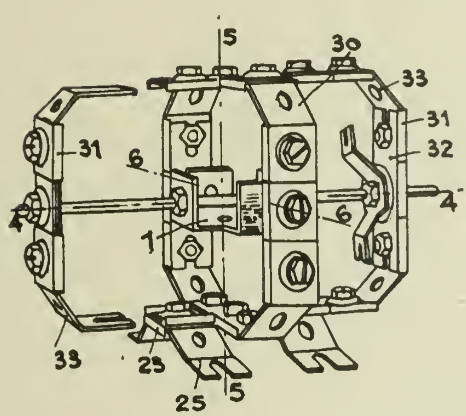
.Fig.5.



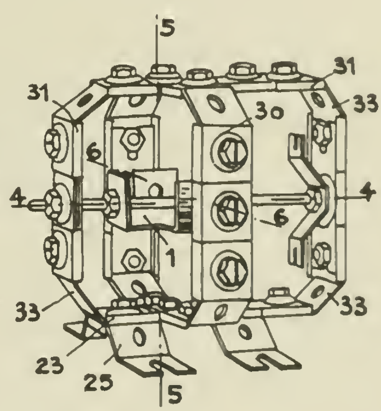
.Fig.6.



.Fig.7.



.Fig.8.



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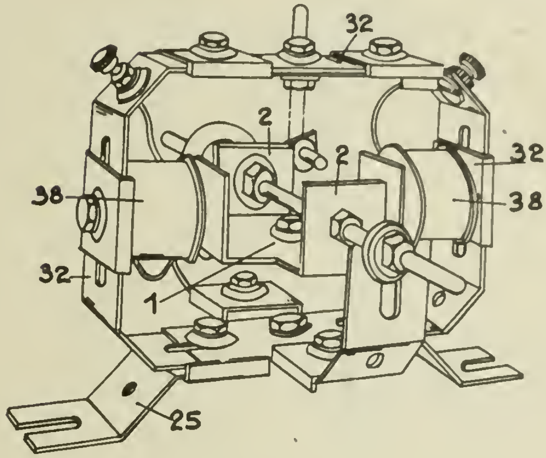
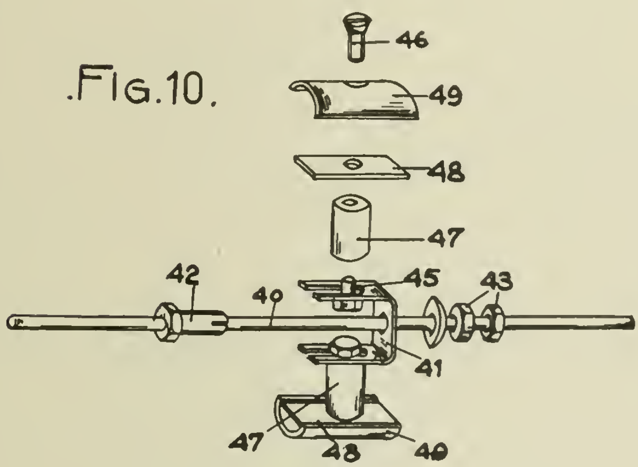
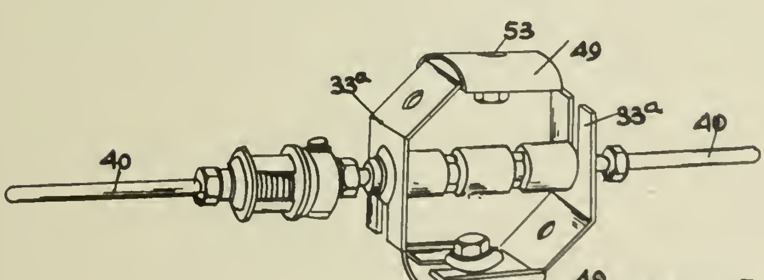
.FIG.9.



.FIG.10.



.FIG.13.



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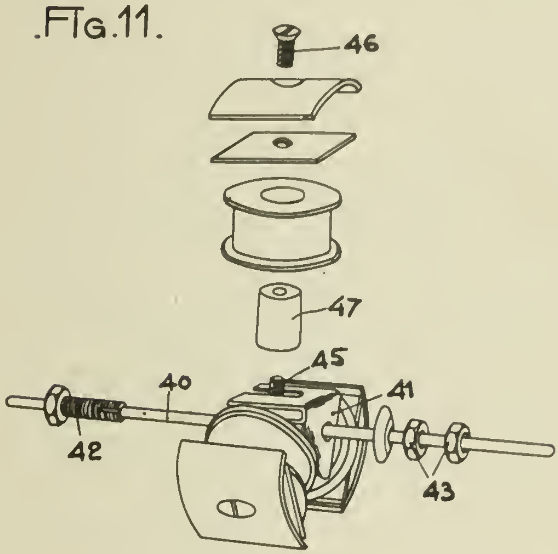
.FIG.11.



.FIG.12.

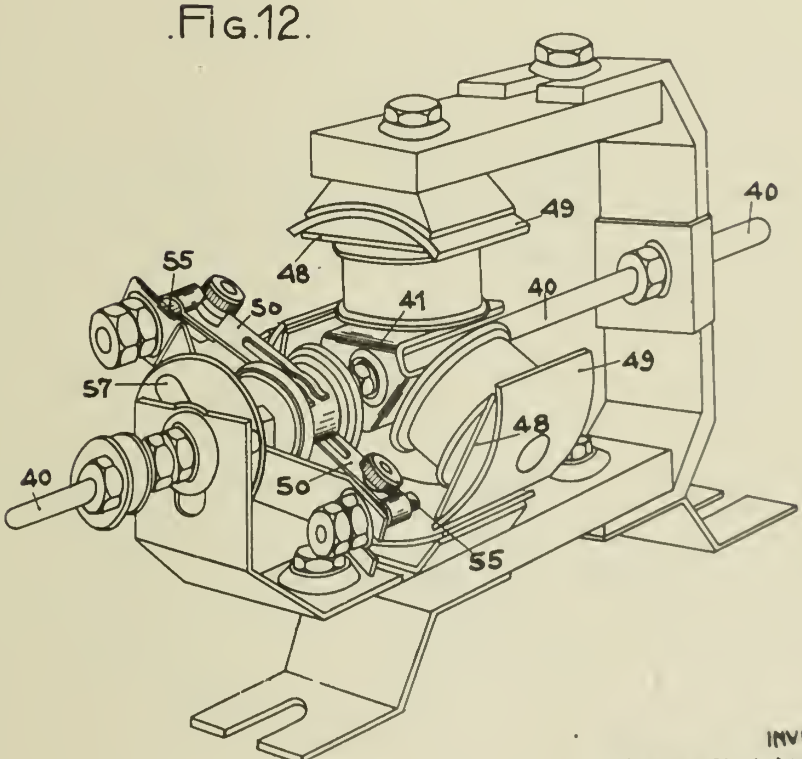


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Fig.14.

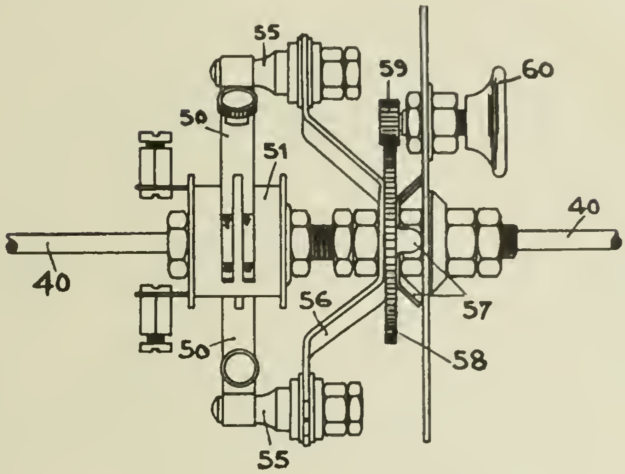


Fig.15.

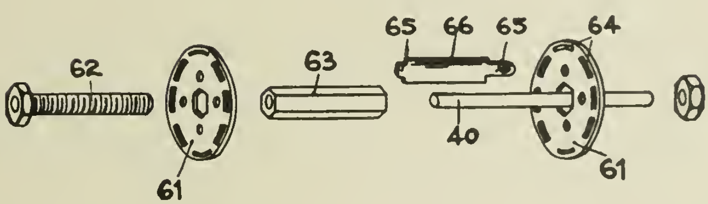


Fig.16.

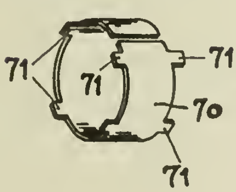
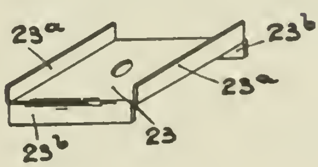


Fig.17.



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Filed April 29, 1939

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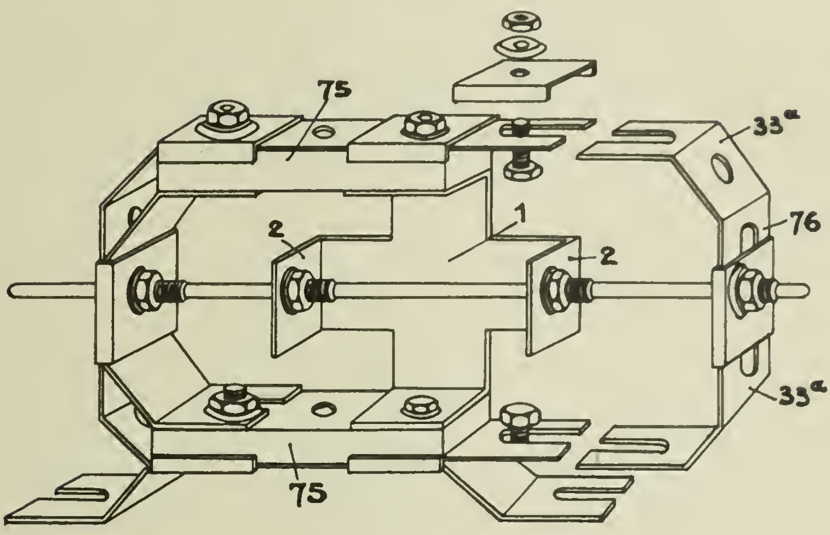
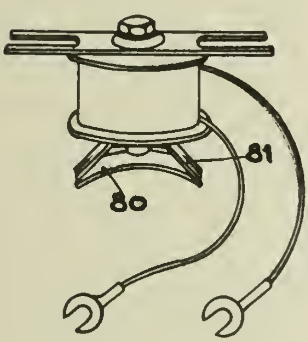
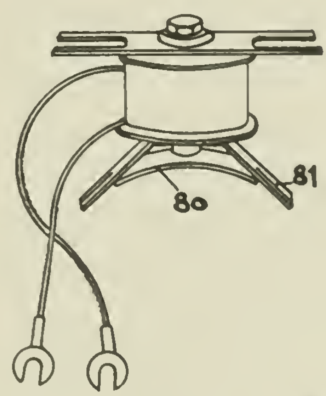
.FiG.18.



.FiG.19.



.FiG.20.



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Published Apr. 27, 1943

Serial No. 270,919

ALIEN PROPERTY CUSTODIAN

MANUFACTURE OF ARTIFICIAL TEXTILE FIBRES

Antonio Ferretti, Milan, Italy; vested in the Alien Property Custodian

No Drawing. Application filed April 29, 1939

This invention concerns improvements in or relating to processes for the manufacture of artificial textile fibres and constitutes an improvement in or modification of the processes described and claimed in the Specification of the Applicant's U.S. Patent Application Serial N. 191,000 dated Feb. 17, 1938 and in the Applicant's U.S. Patent Application Serial N. 96,470 dated August 17, 1936.

In the U.S. Patent Application Serial N. 96,470 it has been stated that in addition to casein derived from milk, mixtures of such casein with raw material of vegetable and also of mineral origin can be employed. In the Specification of Application Serial N. 191,000, it is stated that any casein can be used. According to the present invention casein derived from any raw materials of vegetable origin or of animal origin can be employed for obtaining fibres similar to the artificial wool obtained by the processes described and claimed in the aforesaid Patent Applications.

Among the raw materials which can satisfactorily be employed are, for example, the caseins derived from vegetables (legumen) of various kinds. A suitable vegetable of which there is a plentiful supply throughout the world is the soya bean (glicyne hyspida) from which casein is derived which is so similar to casein obtained from whey as to be known universally as soya-casein. Soya-casein can be treated without difficulty in the manner set forth in the aforesaid Patent Specifications either by itself or mixed with whey casein, for the steps of dissolving, maturing, spinning and rendering insoluble in the manufacture of artificial textile fibres.

In order that the invention may be readily understood an example of the use of a mixture of soya-casein and whey casein will now be described, the procedure being the same when employing soya-casein alone.

In the first step of the process, 50 kilogrammes of soya-casein and 50 kilogrammes of whey-casein are well mixed together and then diluted with 300 litres of water. After a period of one to three hours 17 litres of water, 23 litres of 35° Be sodium hydrate, and 0.350 kilogrammes of sodium hyposulphite are added and the solution is well mixed, preferably in two stages each of 1½ hours; then another 85 to 100 litres of water are added and the solution is filtered at least once and left to mature. As an alternative to sodium hydrate an equivalent quantity of potassium hydrate can be employed, but when the caseins have been washed before use the quantity of 35° Be sodium hydrate is reduced to 17 to 18 litres or the equivalent quantity of potassium hydrate is reduced in a corresponding manner.

In the second step of the process the matured solution is passed through a spinning nozzle immersed in a coagulating bath containing an aqueous solution of sulphuric acid and other salts, such as sodium sulphate, sodium chloride, aluminium sulphate, zinc sulphate, ammonium sulphate or the like; the bath should have a density greater than 1.180 and a sulphuric acid content greater than 25 grammes per litre of bath. Other salts can be added to the bath either singly or in combination, but the temperature thereof must be maintained between 48° C and 58° C preferably at 52° C to 53° C.

As soon as the fibres have coagulated they are collected in a continuous ribbon and are conveyed, preferably under tension through a sodium chloride bath, to which aluminium salts can be added, preferably at a temperature of between 35° C and 50° C. The ribbon is then passed through a second bath containing aluminium salts and sodium chloride, with or without the addition of formaldehyde, preferably at a temperature of between 55° C and 65° C. When the fibres are hard, that is after a few minutes, they are cut to the desired length and dropped into a bath of aluminium salts and sodium chloride, with or without the addition of formaldehyde, preferably at a temperature of between 30° C and 40° C.

After several hours, the fibres are placed, preferably after treatment in a centrifuge, in a bath for rendering them insoluble consisting of formaldehyde, aluminium salts and sodium-chloride at a temperature exceeding 25° C, and preferably at 70° C. Alternatively the fibres are treated in the same bath at a low temperature and then they are washed in running water and treated, preferably after drying, in an aqueous bath of formaldehyde (in this case the addition of aluminium salts and sodium chloride to the bath is not indispensable) at a temperature exceeding 25° C and preferably at 70° C.

The fibres are finally treated with aqueous solutions of monosodic, bisodic or trisodic phosphate, then they are washed and dried.

In the case of manufacturing fibres of sole soya-casein the process followed is the same as in the example above specified.

The process can be modified in various ways without departing from the spirit of the invention.

ANTONIO FERRETTI

Published Apr. 27, 1943

Serial No. 272,652

ALIEN PROPERTY CUSTODIAN

HYDRAULIC MECHANISM FOR PRODUCING A RECIPROCATING MOTION

Fritz Egersdörfer, Berlin, Germany; vested in the Alien Property Custodian

Application filed May 9, 1939

My invention relates to improvements in hydraulic mechanism for producing a reciprocating motion, and more particularly in hydraulic mechanism designed for use in connection with certain machine tools such as shaping machines and horizontal and vertical planing machines, and in which the velocity of the working stroke is adapted to be regulated, while the return stroke has uniform movement. More particularly my invention relates to hydraulic mechanism of this type in which two pumps are provided one of which is operative during the working stroke and the other one during the return stroke. The object of the improvements is to provide mechanism of this type which is economical in operation and simple in construction, and in which the velocity of the working stroke can be continuously regulated. With this object in view my invention consists in providing a mechanism in which the pump which is operative during the working stroke is adapted to be regulated so as to supply varying amounts of pressure fluid to the feeding device. While the velocity of the working stroke can be regulated, the velocity of the return stroke remains constant, and no means are needed for thus setting the pump controlling the return stroke. By thus varying the output of the pump controlling the working stroke the efficiency of the system is not reduced, because, as distinguished from constructions heretofore proposed, the effect of the pump is not regulated by throttling the supply of the fluid to the said pump but by varying the capacity thereof.

In the preferred embodiment of the invention I provide gear pumps, and preferably gear pumps having one of their gear wheels in common and disposed within the same system. A pump of this construction is simple and it requires little space. Further, the output of one of the pumps which controls the working stroke can be readily regulated by shifting the gear wheels forming the operative parts of the pumps relatively to each other in axial direction so as to vary the capacity of the space included between the teeth of the pump and the volume of fluid conveyed thereby.

For the purpose of explaining the invention an example embodying the same has been shown in the accompanying drawings in which the same reference characters have been used in all the views to indicate corresponding parts. In said drawings

Fig. 1 is a sectional elevation taken on the line 1—1 of Fig. 3 and showing the gear pump, the gear wheels of both pumps being in the position for conveying the maximum of the fluid,

Fig. 2 is a similar sectional elevation showing one of the pumps set to reduced feeding capacity,

Fig. 3 is a sectional elevation taken on the line 3—3 of Fig. 1,

Fig. 4 is a sectional elevation taken on the line 4—4 of Fig. 1,

Fig. 5 is a somewhat diagrammatical elevation partly in section showing the hydraulic mechanism including the pumps, the valve controlling the supply of the pressure fluid, and the cylinder and piston by which reciprocating movement is transmitted to the machine tool or the like.

In describing the invention reference will be made to a hydraulic mechanism comprising two gear pumps having one of their gear wheels in common and disposed within a single casing. The pump has been shown in detail in Figs. 1 to 4. It comprises a casing 1 closed at its ends by heads 2 and 3, and three gear wheels 4, 5 and 6 mounted respectively between bushings 7, 7 and 8, 8 and 9, 9'. The bushings 7 and 8 are fixed to the heads 2 and 3, for example by means of screws 50, and the lower bushings 9, 9' are axially shiftable but not rotatable within the casing 1, the bushing 9' being reduced in length to permit such axial displacement. The upper gear wheel 4 is rotatably mounted on a stationary shaft 10 mounted in the bushings 7, 7 and fixed thereto by means of a pin 51. The gear wheel 4 is mounted on the said shaft 10 by means of an anti-friction bearing 52. The gear wheel 5 is keyed to a shaft 12 rotatably mounted in the bushings 8 by means of anti-friction bearings 53 and passed through a stuffing box 54 provided in the end wall 2, the said shaft being connected to the main driving shaft of the machine tool or the like for being rotated thereby a uniform velocity. The gear wheel 6 is rotatably mounted by means of an anti-friction bearing 55 on a shaft 13 secured to the bushings 9 and 9' by means of keys 56. The shaft 13 is connected with a stem 15 rotatably mounted in the head 3 and formed at its inner end with a head 57 having external screw threads and engaging in internal screw threads of a cylindrical socket 11 made in the bushing 9. The said stem 50 is formed with a collar 58 held in position between the head 3 and a washer 59. Thus, when the stem 15 is rotated the bushing 9, the shaft 13, the bushing 9' and the gear wheel 6 are shifted in axial direction. By shifting the gear wheel to the left, for example into the position shown in Fig. 2, the capacity of the spaces included between the teeth of the gear wheels 5 and 6 and there-

fore the volume of pressure fluid supplied by the pump are reduced.

In the casing of the machine a suction passage 16 and a pressure passage 18 for the pump comprising the gear wheels 4 and 5 and a suction passage 17 and a pressure passage 19 for the pump provided by the gear wheels 5 and 6 are provided, the said suction and pressure passages being adapted to be connected to suction and pressure conduits, as will be described hereafter. It will be understood that the upper pump 4, 5 always conveys the same amount of pressure fluid, while the amount of pressure fluid supplied by the pump 5, 6 is variable and dependent upon the axial adjustment of the gear wheel 6.

As is shown in Figs. 5 and 6 the pump thus described is used in a hydraulic mechanism for producing reciprocating movement, which is connected for example to a planing machine (not shown). The mechanism has been illustrated in Figs. 5 and 6. The pump is connected with a controlling valve, comprising a cylinder 28 having three cylindrical slide valves 29, 30 and 31 shiftable therein, the said slide valves being connected with each other and with a lever 45 rockingly mounted at 60. The slide valve is connected by pipes 26 and 27 with the opposite ends of a cylinder 20 in which a piston 21 has reciprocating movement. The piston rod 22 of the said piston is connected with a head 23. By the said slide valves the cylinder 28 is divided into four chambers which are connected with the suction and pressure passages of the pump. The pressure passages 16 and 17 of the pumps are connected by pipes 32 and 33 respectively to the chambers 44 and 42 provided between the slide valves 29 and 30 and 30 and 31. The suction passages 18 and 19 are connected by pipes 40 and 41 with a tank 38 containing the pressure liquid. The said tank is further connected by a pipe 39 and branch pipes 34, 36 and 37 with suitable parts of the valve casing 28.

In the position of the slide valves 29, 30 and 31 shown in Fig. 5 pressure fluid is supplied to the cylinder 20 from the lower pump 5, 6 and through the pipe 33, the chamber 42, and the pipe 26 in a direction for transmitting feeding movement to the planing machine. The volume of pressure liquid supplied by the said pump to the chamber 24 of the cylinder 20, and therefore the velocity of the feeding movement depends on the position of the gear wheel 6. The liquid is forced from the chamber 25 through the pipe 27 and the chamber 43 to the pipes 34, 39 and the tank 38. While the lower pump thus transmits feeding movement the upper pump runs idle, the liquid delivered therefrom through the pipe 32 being immediately returned through the pipes 35 and 39 to the tank 38. It will thus be apparent that the velocity of the feed may be regulated by shifting the gear wheel 6.

For returning the feeding mechanism the slide valve 29, 30, 31 is set into the position shown in Fig. 6. Now the lower pump runs idle, the liquid delivered therefrom and through the pipe 33 immediately returning through the pipes 36 and 39 into the tank 38. The pressure fluid of the upper pump flows through the pipe 32, the chamber 44 and the pipe 27 into the right hand chamber 25 of the cylinder 20, so that the piston 21 and the parts connected therewith are shifted to the left. The fluid contained within the chamber 24 is returned to the tank 38 through the pipe 26, the chamber 61 and the pipes 37 and 39. It will be understood that the velocity of the return movement is always the same and that it is independent of the position of the gear wheel 6.

The slide valve 29, 30, 31 is operated by means of the lever 45 which is adapted to be engaged by stops 46 and 47 provided on the head 23, the said stops being set so that the valve is reversed at the ends of the strokes.

FRITZ EGERSDÖRFER.

PUBLISHED	**F. EGERSDÖRFER**	**Serial No.**
APRIL 27, 1943.	HYDRAULIC MECHANISM FOR PRODUCING A RECIPROCATING MOTION	**272,652**
BY A. P. C.	Filed May 9, 1939	2 Sheets-Sheet 1

Fig. 1

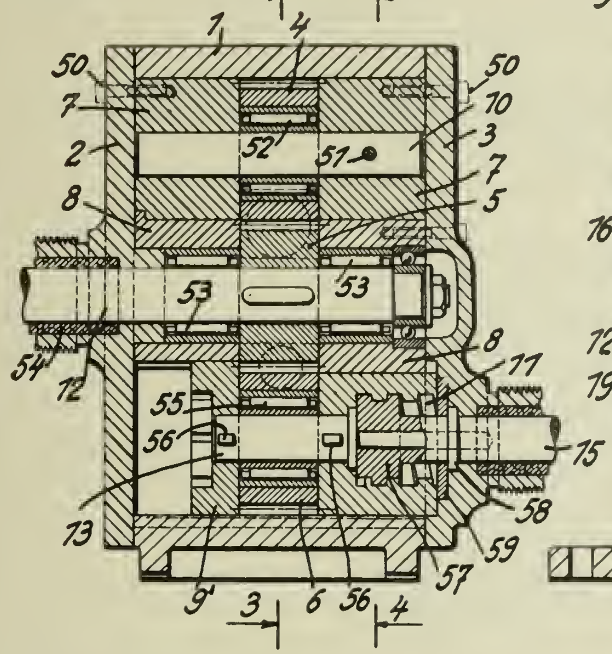


Fig: 3

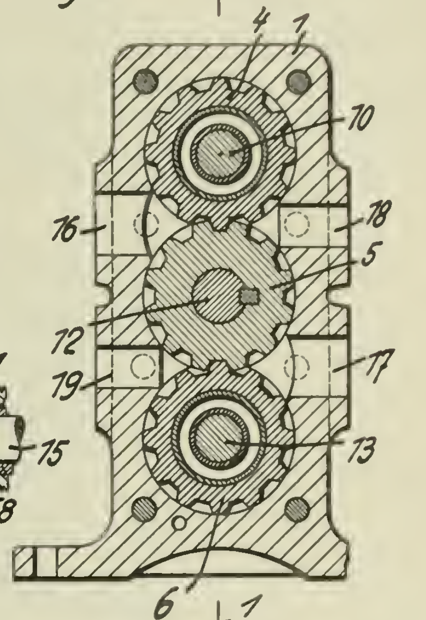


Fig. 2

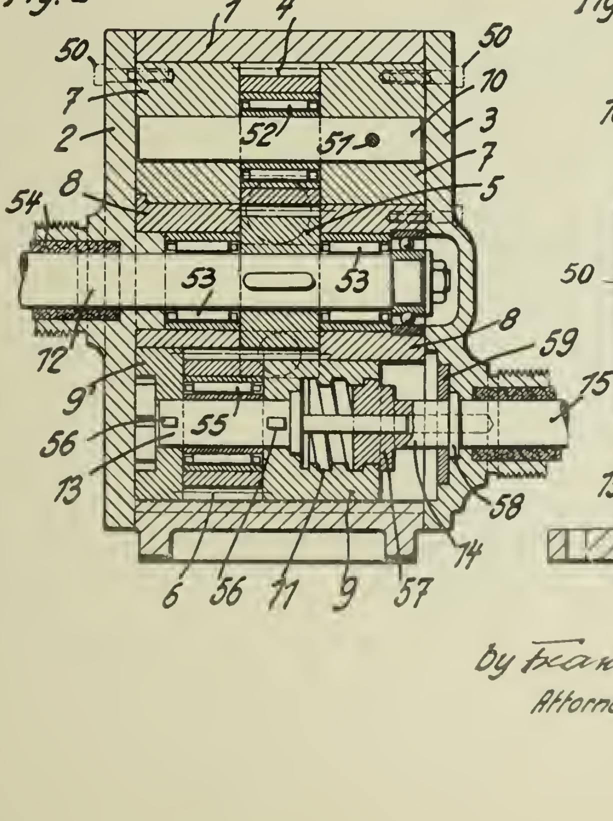
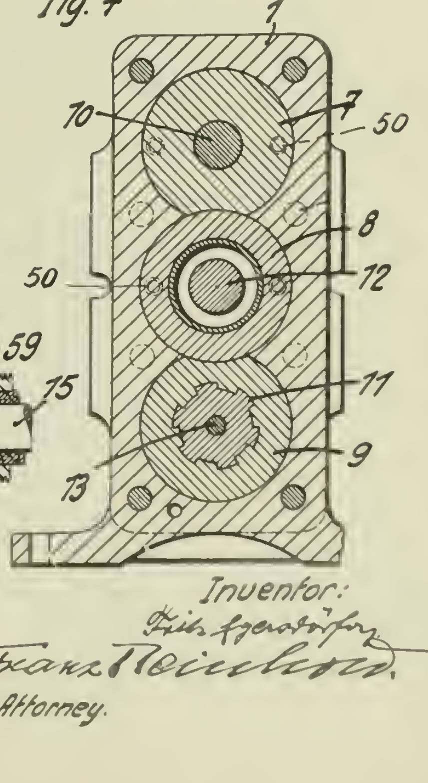


Fig. 4



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APRIL 27, 1943.

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HYDRAULIC MECHANISM FOR PRODUCING
A RECIPROCATING MOTION
Filed May 9, 1939

Serial No.
272,652

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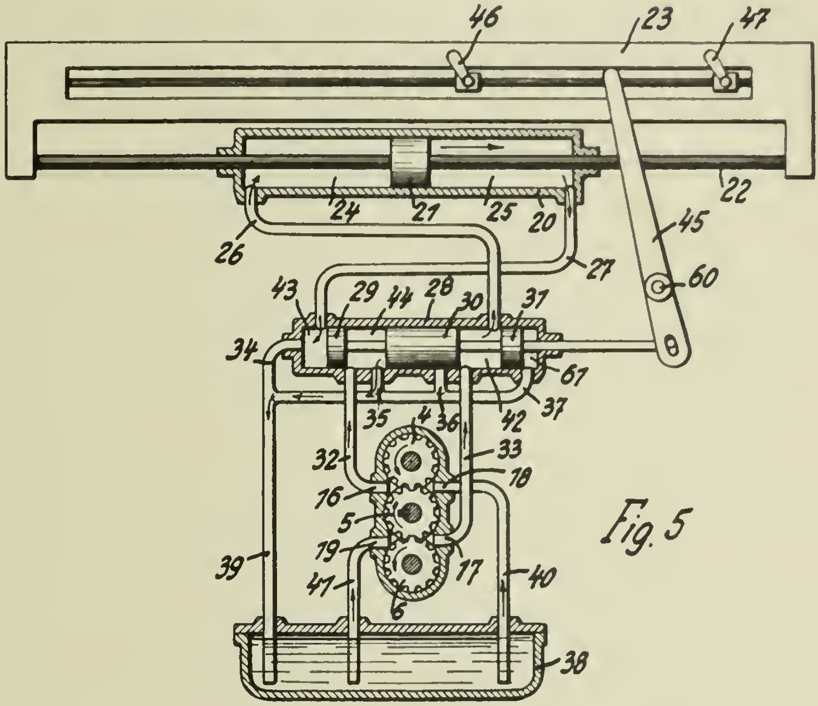

Fig. 5

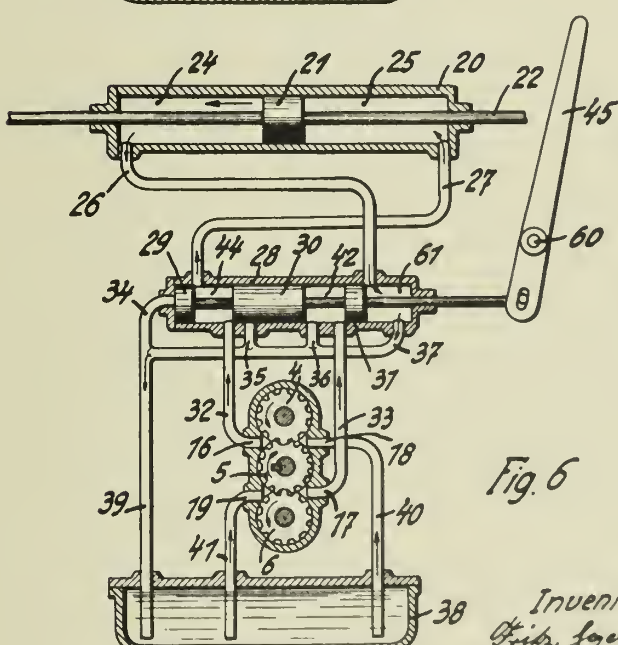

Fig. 6

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Published Apr. 27, 1943

Serial No. 272,716

ALIEN PROPERTY CUSTODIAN

METHOD OF MANUFACTURING HOLLOW VALVES

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Application filed May 9, 1939

It is known to make the valves intended for high efficiency engines, such as airplane engines, of special steels such as austenitic steels, said valves being of hollow structure and the central recess or chamber formed in the valve being filled with a body which is a good conductor of heat, such as sodium, so as to ensure a good outflow of heat from the valve in question.

Up to the present time, valves of this kind were obtained by starting from a metallic blank, and shaping it by machining to the desired form. The chief drawback of these usual methods of manufacture is that the fibers of the metal are cut off in the machine parts, which constitutes a point where the metal is likely to weaken, where breakings of the metal mass can occur, and where corroding actions have a maximum efficiency. Furthermore, these machining operations are difficult to carry out, due to the small diameter of the valve stem, through which must pass the tools which hollow out nearly the whole of the valve head, so that it is difficult to obtain a valve sufficiently hollow for obtaining the presence of a considerable amount of the heat conducting body which eliminates heat and exerts its action over a considerable surface.

According to an important feature of the present invention, the valve is obtained from a blank, constituted by a flat disc of sheet metal, strip iron, metal flattened by forging, and so on. This disc is subjected to one or several gradual operations, consisting in bulging, stamping, forging, or swaging it, either in the hot or in the cold state, so as to obtain a cylindric cup-shaped element having a flat or substantially flat end. Then the lateral wall of this element is subjected to a forging operation adapted to reduce its diameter, also in several steps, either in the hot or in the cold state, whereby the head and the stem of the valve are formed, the end face of the cup-shaped element and the adjoining portion of the lateral wall thereof constituting said head of the valve.

These operations may be completed by a shaping operation, performed either on the roughly worked blank before it has been worked down, or after this working down operation.

The valve thus obtained will not call for any grinding or similar operation. It is possible, for all the parts of the valve, to obtain an accuracy sufficient for eliminating any other machining operation proper.

On the other hand, we have found that this method of manufacturing valves applies in favorable conditions if use is made of austenitic steels because the stamping or working down and other operations call for a matter which has high elongation properties, which is the case for austenitic steels, to a considerable degree. On the other hand, as austenitic steels are especially adapted for constituting valves, as it is known, owing to the fact that they support well the effects of high temperatures, their use in the method according to the present invention is particularly advantageous.

The valves made according to this new method are characterized by the fact that the metal fibers are not cut off and follow exactly the outline of an axial section.

Furthermore, the central chamber formed in these valves ensures, for the heat conducting body which is to be housed inside said chamber, the maximum of volume and area of action.

Finally, as the body of the valve utilizes a minimum amount of matter, the inertia and the weight are reduced to a minimum, and the consumption of matter for the manufacture is reduced to a minimum.

Through the known means used in working down machines, or swage machines for reducing the diameter of a piece of work, this operation is normally performed on a mandrel in the case of a machine having opening dies on the inside of which the workman places, without difficult the rough worked piece in suitable position. On the contrary, the engagement of a rough-worked piece in a working down machine having ordinary dies, that is to say non-opening dies (which is a high output machine) is more delicate, in particular concerning the centering of the piece. This is due to the fact that the working down operation, or reduction by forging of the diameter of the piece, must take place over the whole length of the rough-worked piece, so that there does not remain any cylindrical part available for holding the piece in correct position in the machine.

According to the present invention, we provide, in order to facilitate the use of working down machines having ordinary dies, means for holding the piece of work in correct axial position during its engagement between the dies, said means consisting in a system of elastic jaws located at the inlet end of the dies and capable of being moved apart either at will, under the effect of a control member, or automatically by the piece of work itself when it is fully engaged between the dies.

According to a modification of the present invention, which is based on the same principle as above explained and permits of obtaining equiva-

lent results, we start from a tube open at both ends, instead of starting from a flat disc. One of the ends of said tube is first closed by bringing the lips thereof into contact through metal working operations which are known in themselves. In this way we obtain a cup-shaped piece the lateral wall of which is subjected to the working down or diameter reducing operation above referred to, so as to constitute the axial hollow stem of the valve.

When it is advantageous to fit the valve head with a portion of a special metal or alloy, so as to constitute the frusto-conical annular bearing surface of the valve, this special metal or alloy addition may be fixed in a grooved-shaped recess obtained by bulging of the corresponding part of the piece of work. This groove is obtained either in the course of the successive working down steps necessary for making the valve or in the course of supplementary step performed after having obtained the valve.

Other feature of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 is a cross section of a blank used according to the present invention;

Figs. 2 to 6, inclusive, are sectional views roughly illustrating the successive steps of the manufacture of a hollow valve from a blank such as that of Fig. 1, according to the invention;

Figs. 3ª to 6ª are views corresponding to Figs. 3 to 6 but showing accurate cross-sections of a blank in the case where working down is performed without any internal mandrel.

Figs. 7 and 8 illustrate further steps in machining and working down.

Fig. 9 is a front view of a device for holding the piece of work in a working down machine to be used in connection with the invention;

Fig. 10 is a sectional view on the line X—X of Fig. 9;

Fig. 11 is a front view of a working down machine of a known type showing the arrangement of the dies (the number of which is preferably four) used for making the valves according to the invention;

Figs. 12 to 15 are sectional views illustrating the successive steps of the manufacture of a hollow valve from a cylindrical tube, according to the invention;

Fig. 16 is a sectional view of a finished hollow valve according to the invention, with an annular metallic part added thereto;

Fig. 17 illustrates a supplementary operation which permits of obtaining the hollow valve shown by Fig. 16.

Fig. 1 shows the blank 1 for manufacturing the hollow valve according to the present invention. This blank is for instance constituted by a steel sheet disc, for instance of a thickness of 2 or 3 mms. It might also consist of a disc of the same thickness cut off from strip iron, or a disc obtained by circular stamping or by flattening in a press a block of solid steel.

This disc is stamped into a cup-shaped element as shown by Fig. 3. In order to obtain this result, it is quite clear that the stamping or bulging operation, or any other treatment, performed either in the hot or in the cold state, must be carried out very gradually and with all the precautions used by people skilled in the art for avoiding cracks in the metal and also folding thereof. For this purpose, the method can be carried out in several steps and one of these intermediate steps is shown by Fig. 2.

The cup-shaped element is then worked for instance by shaping, pushing or forging either on hot or on cold, to progressively reduce its diameter in successive steps as illustrated by Figs. 4, 5 and 6.

The working down or raising-in machine may be of any suitable kind preferably of the type including more than two dies, for instance four dies.

In the kind of machine illustrated by way of example by Figs. 11 and 12, the working down machine includes four dies 20, a stator 26, with an annular row of rollers 27, and a rotor constituted by four dies, each of which is rigid with an anvil 20*a* which carries a roller 28.

Rotation of the dies or swages at high speed produces, every time rollers 28 pass on the successive rollers 27 of the stator, an alternating radial displacement of said dies, subjected to the effect of the centrifugal force (as shown in solid lines and in dotted lines in Fig. 12 for two different angular positions of a die), which produces the hammering by the dies of the piece of work to be treated in the machine.

Several successive operations, performed either in the hot or in the cold state, permit, for instance, of successively obtaining, from the cup-shaped element shown on Fig. 3ª, the three shapes shown by Figs. 4ª, 5ª and 6ª. Of course, the number of these operations and the shape of the tools depend upon the nature of the metal on the one hand and the size of the finished valve, on the other hand.

In particular, it results from Fig. 6ª that, due to the fact that a cylindrical mandrel has not been inserted into the recess 4 of stem 3, in the course of the working down operation, we obtain, as a consequence of the reduction of diameter of the stem, a wall of stem 3 and neck 6 which is substantially thicker than the wall 2 of the cup-shaped element 1 of Fig. 3ª. This increase of thickness of the stem is useless from the point of view of the strength of the valve, and it is disadvantageous due to the increase of weight it involves.

The next step of the process (Fig. 7) therefore consists in removing on a lathe this excess of metal, except at the end 5 of stem 3, and also, eventually at neck 6, where a certain reinforcement is sometimes advantageous from a mechanical point of view.

In order to close the recess of the valve, it suffices then to work down the end 5 so as to bring down its external diameter to a value equal to that of the machined stem, in a manner which is known in itself (Fig. 8).

After the end portion of the stem has been cut off along line *a*—*b*, the valve is finished, unless it is desired to fit it, for forming its frusto-conical annular bearing surface, with a lining element 7, made for instance of tungsten cast iron or any other suitable metal or alloy, for instance an alloy which is known in the market under the commercial name of "stellite" (Fig. 16).

If the groove 8, necessary for the fixation of this lining element, has not been formed in the course of the preceding working down operations (which is possible if the dies are made of suitable form for this purpose), a supplementary working down operation may be performed in closed dies 9, in a machine having opening dies (as shown by

Fig. 17). Or this groove may be formed in any other suitable manner.

As above stated, the difficulty that is encountered when it is desired to carry out the operations illustrated by Figs. 4 to 6 in an ordinary die-forging machine for reducing the diameter of a piece of work, consists in the impossibility of catching the valve head, which is to be engaged wholly between the dies, by the push piece **22** (Fig. 10) which is to engage the piece of work between the dies.

The holding and centering device illustrated by Figs. 9 to 11 permits of obviating this difficulty. This device is constituted by a circular frame **10** having radial slideways **11** in which jaws **12** can slide. A spring **13**, housed on the inside of each of these jaws constantly tends to urge it toward the center. On a cylindrical bearing **14** of frame **14**, there is rotatably mounted an annular element **15** the periphery of which includes as many inclined portions or cam or eccentric portions **16** as there are jaws **12**. Each of these inclined surfaces cooperates with a spindle or a roller **17**, carried by the corresponding jaw for moving said jaw away from the center of the device when annular element **15** is turned in the direction of arrow *f*, by acting on a lever **18**, rigid with **15**.

The apparatus thus constituted being fixed to the frame of the die-forging or working down machine, through a support **19**, in line with the axis of said machine, in front of dies **20**, the rough-worked valve element **21** is engaged between the jaws **12**, which are then located at a distance from one another, and between dies **20**. Then the jaws are moved toward the center by acting on lever **18** in the direction opposed to that indicated by arrow *f*, so that the jaws elastically hold the stem of the piece of work.

The push piece **22** of the machine is then moved forward, for instance through pneumatic means. The stem of valve **21** gradually engaged between dies **20**, while remaining held and centered by jaws **12**, until the latter are moved apart, against the action of springs **13**, by the valve head **21**, which acts on the inclined surfaces **23** of said jaws **12**. The head can thus pass and be engaged wholly between the dies, until push piece **22** comes into contact with the dies. It is no longer necessary, then, to hold the valve in axial position by means of jaws **12**, as the action of the dies is now sufficient.

According to a modification of the invention, the hollow valve of the kind above set forth can be obtained by starting from a cylindrical tube **30**, as shown by Fig. 12. This tube is subjected to one, or preferably several, forging, stamping or working down operations, either in the hot or in the cold state, so as to give it the successive shapes illustrated by Figs. 13 to 15. In this way, we close one of the ends **31** of the tube and we obtain a kind of cup-shaped element **32** which is wholly analogous to that shown by Fig. 3.

In order to obtain this result, and if necessary, the end part of the cup-shaped element may be cut off, at **31**, along line *c—d*, this last mentioned operation being performed between any two of the operations illustrated by Figs. 13 to 15.

The cup-shaped member **32** thus obtained is then subjected to the different operations above described, in the course of which the diameter of the blank is reduced by forging so as to give it the final form to be obtained.

In this case also, the valve head may be fitted with a lining portion such as **7**.

In a general manner, while we have, in the above description, disclosed what we deem to be practical and efficient embodiments of the present invention, it should be well understood that we do not wish to be limted thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention as comprehended within the scope of the accompanying claims.

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METHOD OF MANUFACTURING HOLLOW VALVES
Filed May 9, 1939

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272,716
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Fig_1

Fig_2

Fig_3

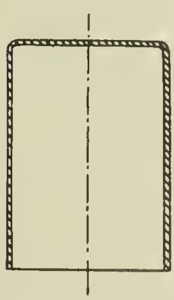


Fig_4

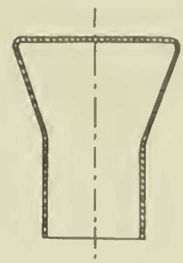


Fig_5

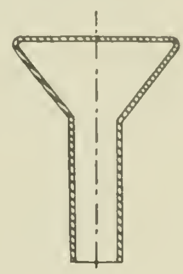
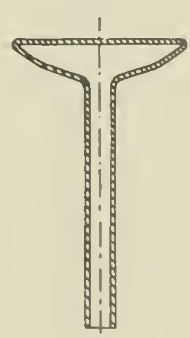


Fig_6



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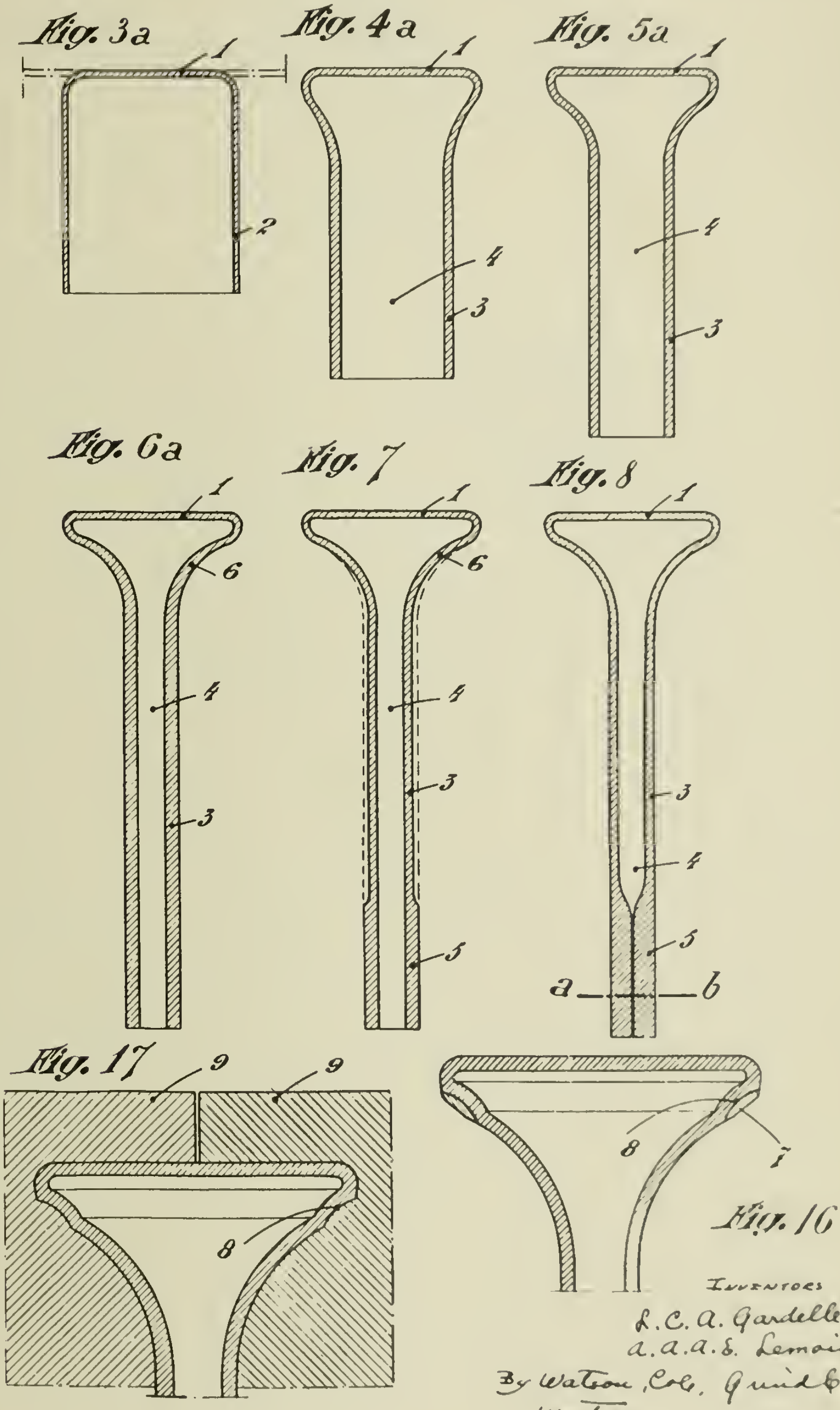
METHOD OF MANUFACTURING HOLLOW VALVES
Filed May 9, 1939

Serial No.
272,716
4 Sheets-Sheet 2



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L. C. A. GARDELLE ET AL
METHOD OF MANUFACTURING HOLLOW VALVES
Filed May 9, 1939

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272,716
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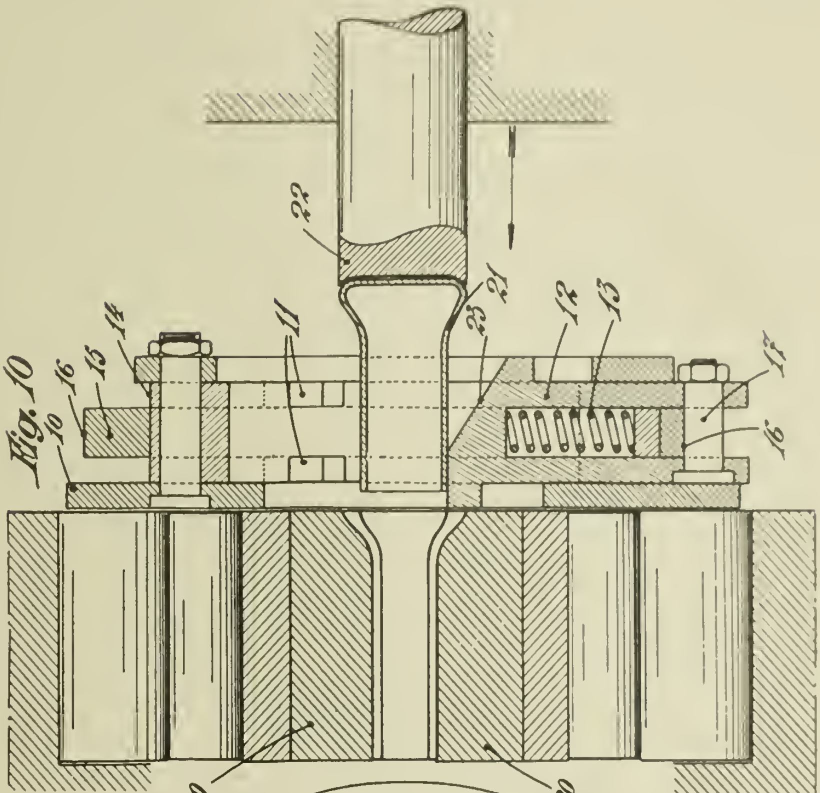

Fig. 10

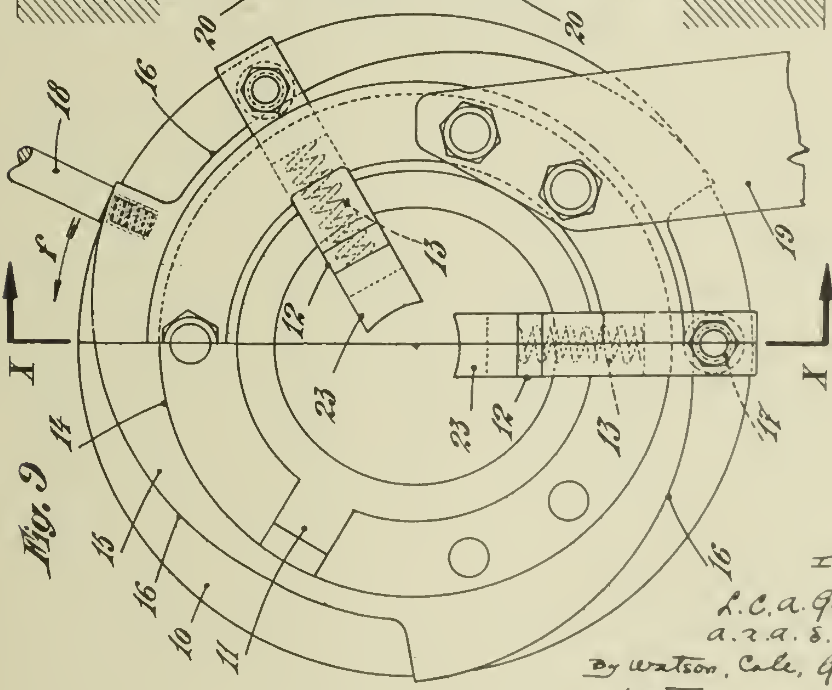

Fig. 9

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METHOD OF MANUFACTURING HOLLOW VALVES
Filed May 9, 1939

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272,716
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Fig. 11.

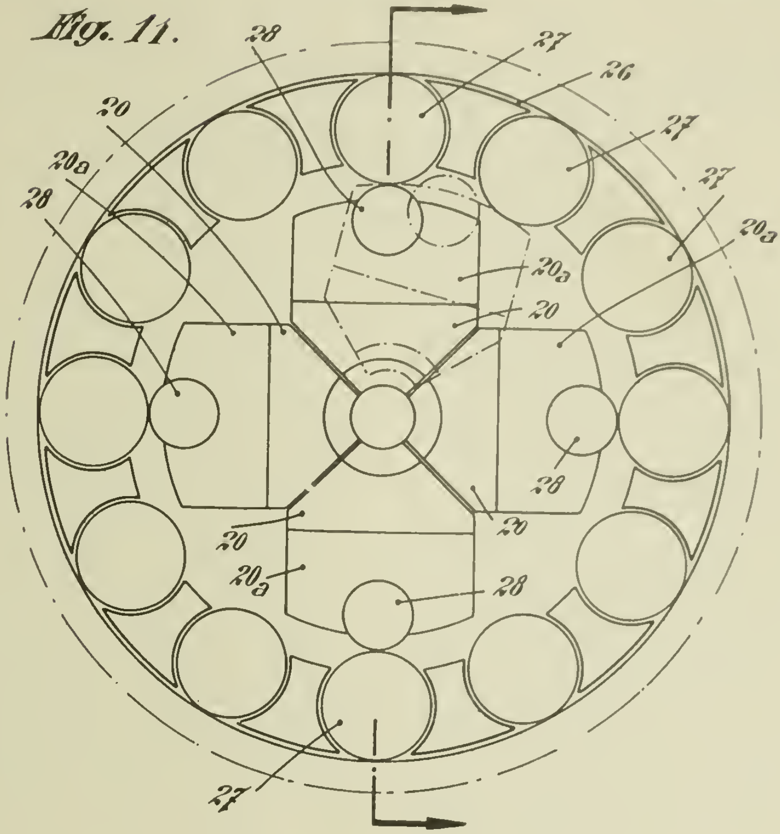


Fig_12

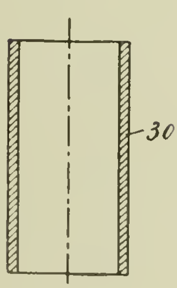


Fig_13

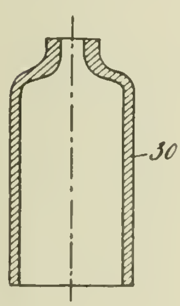


Fig 14

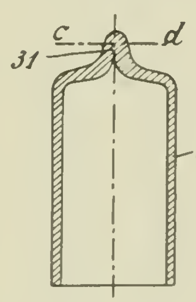
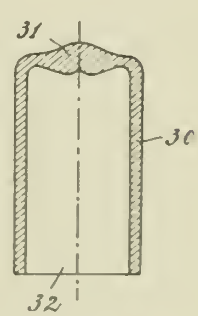


Fig_15



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Published Apr. 27, 1943

Serial No. 273,370

ALIEN PROPERTY CUSTODIAN

APPARATUS FOR STORING AND CONVEYING CARD INDEX CARDS AND OTHER ARTICLES ACCOMMODATED IN CONTAINERS

Otto Alfred Becker, Saarbrucken, Germany; vested in the Alien Property Custodian

Application filed May 12, 1939

This invention relates to an apparatus for storing and conveying card index cards and other suitable articles accommodated in containers or the like, any one of which, after selection by means of a setting device, may be automatically removed from the other containers and then moved upwards into a working field by means of a conveying mechanism, only the selected container being moved whereas all the other containers remain in their position of rest.

Several embodiments of the invention are illustrated by way of example in the accompanying drawings, in which:

Fig. 1 is a vertical section on line I—I of Fig. 2 through the apparatus for storing and conveying the card index cards accommodated in containers, which apparatus is arranged in a table,

Fig. 2 is a top plan view of Fig. 1 with the table top removed and containers removed from the right side to show the parts located below these containers,

Fig. 3 is a portion of a vertical section on line III—III of Fig. 4 and shows the engagement and conveying mechanisms on the sides of the containers,

Fig. 4 is a part plan view of the laterally arranged mechanisms illustrated in Fig. 3,

Fig. 5 shows in part vertical section on line V—V of Fig. 4, the arrangement of the containers on the guide bars and also the sliding-in mechanism,

Fig. 6 shows in part vertical section on line VI—VI of Fig. 4, a portion of the arrangement of the containers with container ejector,

Fig. 7 shows in elevation a raising and lowering conveying mechanism of modified construction,

Fig. 8 is a part plan view of Fig. 7.

Fig. 1 shows a table, consisting of a base plate 36, end walls 35 and a table top 34, and accommodating on the right and left container frames 1 arranged close together one above the other in horizontal position on guide bars 5 and containing card index supporting plates 2. The guide bars 5 enable each container 1 to be shifted laterally into the free middle space of the table.

Each container is held in its extreme position by an electro-magnetically actuated engaging device. This engaging device consists of a catch 7 (Fig. 4) oscillatably mounted on an axle 15 and pulled by a spring 7*a* into engagement in a slot 26 in the container when the latter is in its extreme position. The catch is connected to an electro-magnet 8.

If the electro-magnet 8 is excited, the pawl will be disengaged from the slot 26. An ejector 6 oscillatable about an axle 14, exerts under the action of a spring 6*a* a continual pressure on the container resting in its extreme position and pushes the container on the guide bars 5 so far out of the pile of containers that a conveying mechanism 3/13 driven by an electric motor 21 grips the container and completely removes it from the pile. The conveying mechanism consists of a shaft 13 with pinion 3 keyed thereon and rotated by the motor 21 through the intermediary of driving belts 37, a shaft 23, a worm 38 and worm wheel 39. The side walls of the container carry racks 4 (Fig. 4) in which pinions 3 engage as soon as a container is shifted by an ejector 6 out of the pile of containers.

Pressure rolls and corresponding pressure surfaces (not shown) may be provided instead of the pinions 3 and racks 4.

When the container has been pushed entirely out of the pile of containers, it strikes against a contact bar (not shown) by which the circuit of the motor 21 is interrupted so that this motor and the conveying mechanism 3/13 come to a standstill.

By the movement of the contact bar a second circuit is closed at the same time as the first circuit is interrupted, this second circuit drives a second motor 22. This motor 22 drives, through the intermediary of driving belts 40, two spindles 18 each provided with right and left handed threads. The ends of lazy tongs 17 are moved towards the middle of the spindles 18 by means of nuts. Thus, the lazy tongs 17 both on the left and on the right are caused to extend, that is to move upwards. These two pairs of lazy tongs 17 are connected to laterally arranged lazy tongs 16 so that these latter are compelled to carry out the same movements as the lazy tongs 17. Thus, the lazy tongs 16 and 17 form together a rectangular structure which carries a conveyor plate 27. During the upward movement of the conveyor plate 27 the carrier plate 2, removable from the displaced container 1, is raised and brought into a window 43 (Fig. 1) in the working field of the table top 34, this window 43 being automatically opened during the ascent of the lazy tongs. At this moment a trip contact (not shown) is actuated by nuts moving on the screw spindles 18 and interrupts the circuit of the motor 22 with the result that the screw spindles 18 and lazy tongs 16 and 17 come to a standstill. To attain an angle portion of the depressed lazy tongs to facilitate the ascent a bridge 19 is provided which lifts the lazy tongs through the intermediary of pressure springs 20 arranged under

the points of intersection. The lazy tongs are so constructed that the individual levers of the tongs, during the contraction of the tongs, do not lie superposed but juxtaposed so as not to lose more space in the vertical direction than is necessary.

If the container is to be returned to its place in the pile of containers, the operator actuates an electric contact which closes the circuit of the motor 22 in such a manner that this motor rotates in the opposite direction to that in which it rotated before, and returns the lazy tongs with the conveyor plate 27 into their position of rest, the card index supporting plate 2, during its descending movement, being again taken up by the frame 1. In the position of rest the conveyor mechanism 16—20, or the motor 22, is automatically switched off and at the same time the motor 21 is switched on in the opposite direction with the result that the container frame 1 with the supporting plate 2 is conveyed into the pile of containers until the conveying mechanism 3/13 serving for the lateral displacement disengages. In this position the container switches off the motor 21 and closes the circuit of the electro-magnet 12 by means of a contact bar. A lever system is connected to the electro-magnet 12 and movable about a fixed axle 11*b* by which a push-in lever 9 is caused to engage in a slot 25 in the container and thus shifts this container into its extreme position (Figs. 2, 4, 5). As soon as this position has been reached, the catch 7 engages the slot 26 and holds the container firmly in this position. At the same time the ejector 6 is tensioned by being forced back (Figs. 2, 4, 6).

Electro-magnets 8 are coordinated one to each container 1 and can each be actuated from the working field by a press button not shown.

Figs. 7 and 8 show an alternative form of construction of a raising and lowering conveying mechanism. In this instance the conveyor plate 27 is raised by stand-like levers 28—29 which are extended by screwing apart and at the same time swung upwardly. These levers are actuated by the motor 22 through the intermediary of a pinion 41 and connecting shaft 45. Each of the levers 28, 29 is raised and lowered by a worm gear 30 by the arm 32 oscillatable about a connecting shaft 44. Bevel wheels 31 are driven through the intermediary of transmission wheels 33 and 42 and impart a rotary movement to the lever section 29 causing this lever to unscrew from the lever section 28, the speed ratio between the up and down swinging movement of the lever and the lengthening or shortening of the lever caused by the unscrewing or screwing movement being synchronized by the ratio of transmission of the wheels 33 and 42. The connecting shafts 44 transmit the driving force of the motor to a similar second pair of levers.

Another modified form of construction of a conveying mechanism is obtained, when screw spindles are used which are provided with alternating sections with and without screw threads. The sections without screw threads are in the same horizontal plane as the containers and thus allow the individual containers, when they are in a certain position, to be laterally displaced into engagement with the screw spindles. This modified form of construction is not illustrated, as screw spindles as such, are sufficiently well known.

The lateral displacement of the containers may be effected in such a manner that they are arranged at an angle of inclination and thus slide laterally out of engagement by gravity.

These apparatus are suitable for the combination with typewriters, calculating, bookkeeping, sorting, multiplying, tabulating, perforating, printing and similar machines because they can automatically feed the desired group of cards, after selection, to these machines with the aid of additional conveying mechanisms.

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PUBLISHED

APRIL 27, 1943.

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APPARATUS FOR STORING AND CONVEYING CARD INDEX CARDS AND OTHER ARTICLES ACCOMMODATED IN CONTAINERS

Filed May 12, 1939

Serial No. 273,370

3 Sheets-Sheet 1

Fig. 1

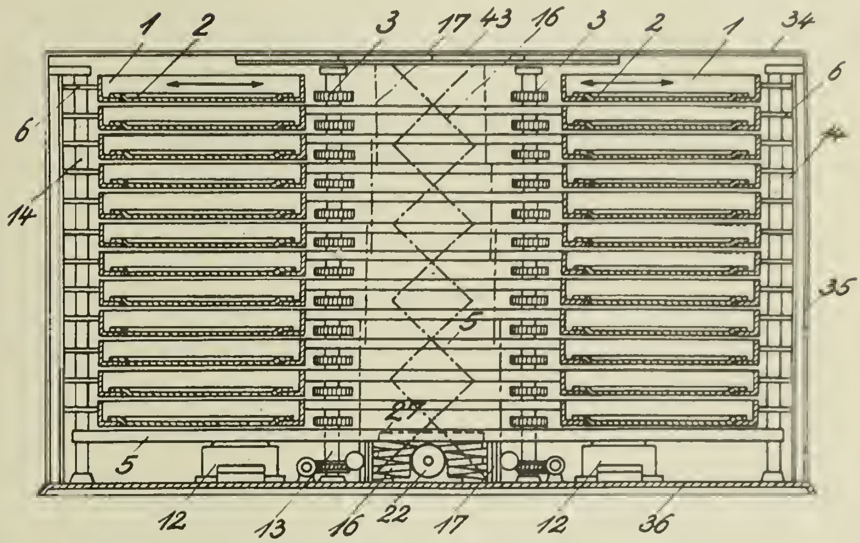
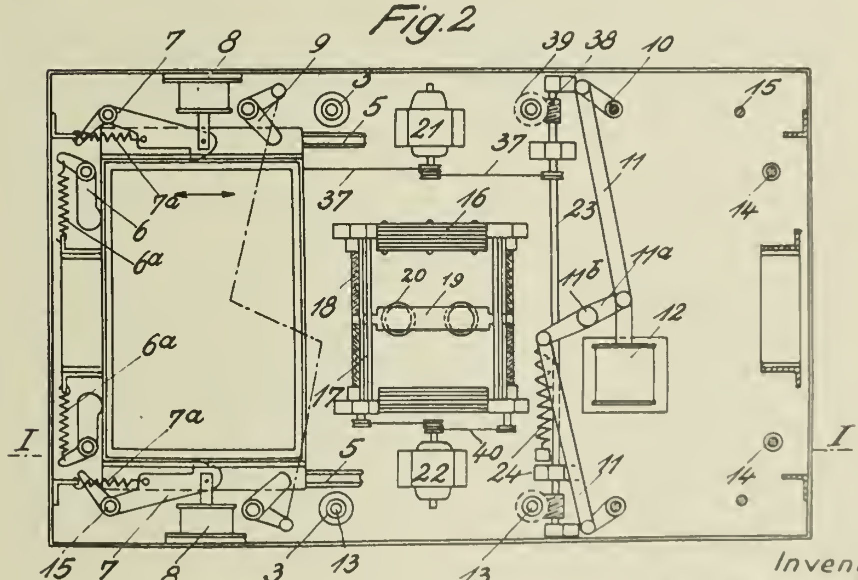


Fig. 2



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PUBLISHED

APRIL 27, 1943.

BY A. P. C.

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APPARATUS FOR STORING AND CONVEYING CARD
INDEX CARDS AND OTHER ARTICLES
ACCOMMODATED IN CONTAINERS
Filed May 12, 1939

Serial No.
273,370

3 Sheets-Sheet 2

Fig. 3

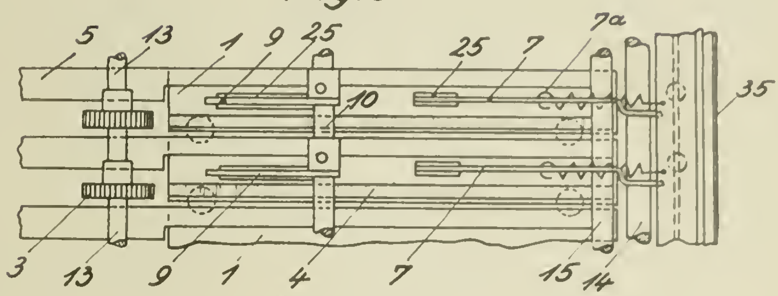


Fig. 4

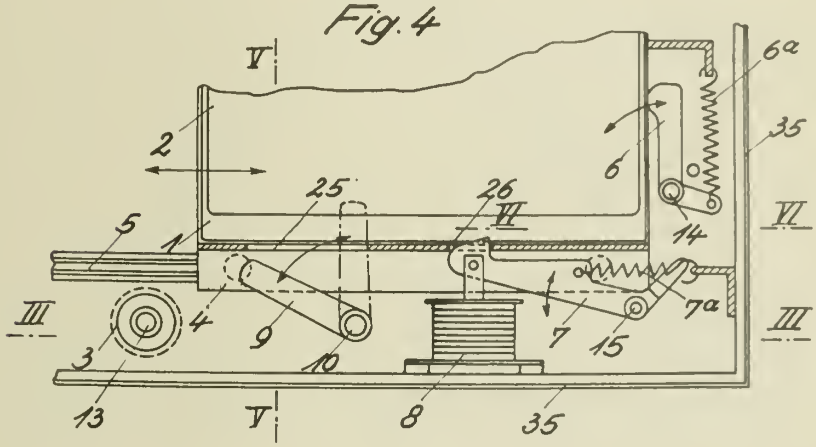


Fig. 5

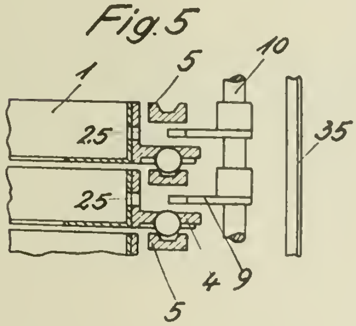
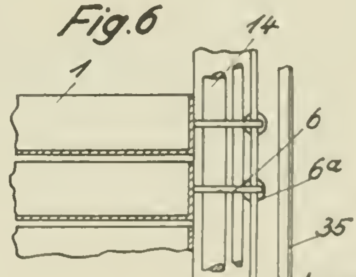


Fig. 6



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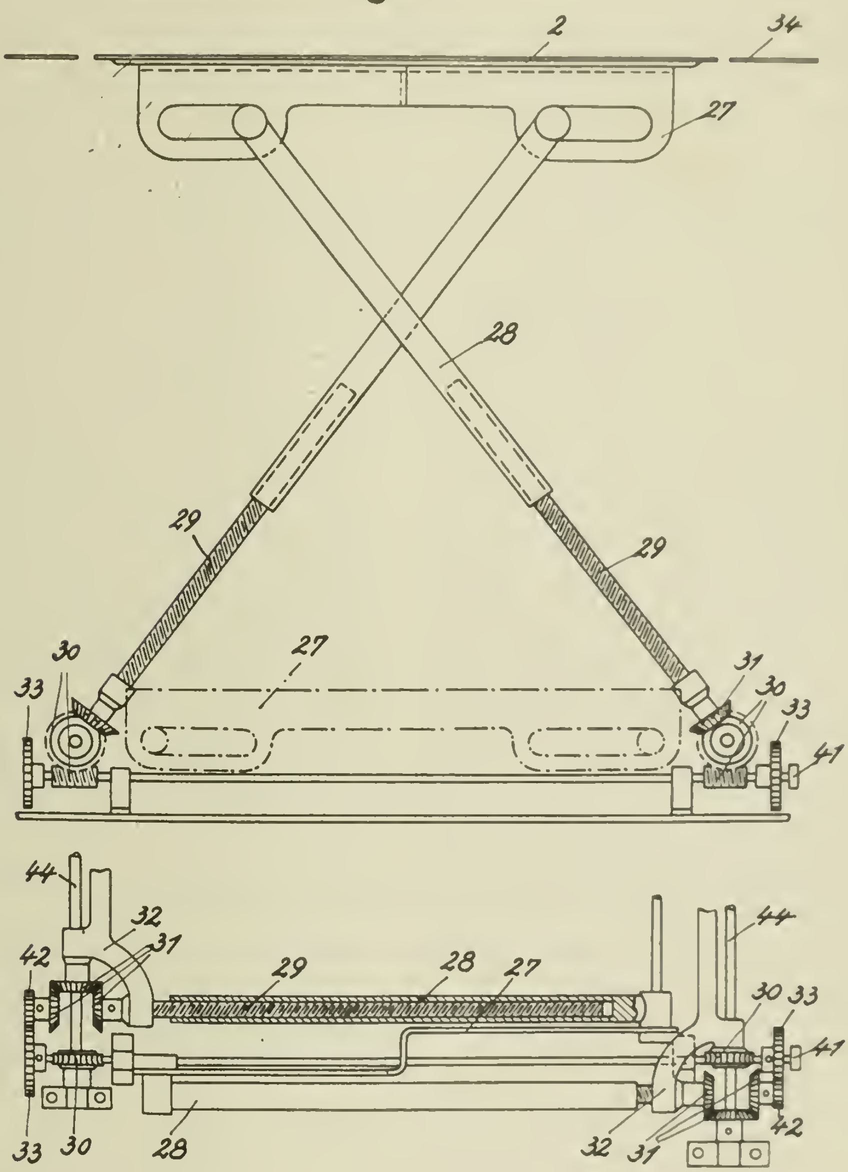
APPARATUS FOR STORING AND CONVEYING CARD INDEX CARDS AND OTHER ARTICLES ACCOMMODATED IN CONTAINERS

Filed May 12, 1939

Serial No. 273,370

3 Sheets-Sheet 3

Fig. 7



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Published Apr. 27, 1943

Serial No. 273,414

ALIEN PROPERTY CUSTODIAN

MONOFILS OF SYNTHETIC RESINS

Emil Hubert, Dessau-Ziebigk, and Herbert Rein, Leipzig, Germany; vested in the Alien Property Custodian

No Drawing. Application filed May 13, 1939

The present invention relates to articles comprising monofils consisting of synthetic vinylresins.

It is an object of the invention to provide brushes and brooms and other articles hitherto made of natural or hog's bristles. This object is accomplished by using as a substitute for such bristles thick monofil threads of polymeric hydrocarbons, their chlorinated derivatives or their mixed polymerizates made by extruding one of these materials from the nozzle of a heated press and stretching the filament to more than double its original length. The artificial bristles thus produced are preferably of the thickness of 300–6000 deniers and have the necessary stiffness and elastic flexibility to enable them to take the place of natural bristles.

The threads which are to be used for making the bristles may be stretched either directly after they have left the nozzle of the press or as a separate operation. For heating the threads preparatory to the stretching operation heated air or another gaseous medium may be used or the stretching may be performed in a hot liquid which has no solvent section. Threads which have not been stretched are unsuitable for use as substitutes for bristles on account of their brittleness.

By polymeric hydrocarbons this invention contemplates polyethylene, polyalkylvinyl ketones and conversion products thereof, polyvinyl ethers, polyvinyl esters; by chlorine derivatives of the hydrocarbons, polyvinylchlorides, after-chlorinated polyvinylchlorides and halogen compounds of rubber; by mixed polymerizates, those which contain one or more of the said hydrocarbons or chlorine derivatives thereof, if desired together with other polymerizable substances. The bristles made of these materials are not only useful substitutes for natural bristles in all their applications, but they surpass the natural bristles in various qualities, particularly by their complete incapacity for swelling in water and in their resistance to the attack of alkali lye, acids and putrefying bacteria. The construction of brushes and the like from these artificial bristles presents no difficulty.

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HERBERT REIN.

[illegible]

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[illegible]	[illegible]

Published Apr. 27, 1943

Serial No. 273,993

ALIEN PROPERTY CUSTODIAN

MANUFACTURE OF PLATES OF LARGE SUPERFICIAL AREA

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Application filed May 16, 1939

This invention relates to a method of forming by pressing from small stuff plates of large superficial area, such as structural plates, doors, walls and the like, and to means and methods of uniformly distributing the material in the matrix of the press.

The invention may be applied with particular advantage when employing such materials as contain as the main constituent any substance of organic or inorganic nature in the form of chippings, shavings, fibres, grains, granules or powder, such as wood chippings, or shavings, wood meal, maize stalks or husks, coffeebean husks, asbestos and the like, and as binding agent adhesive substances such as casein, dextrine, bone glue, natural or artificial resins in the condensation or distillation stage.

In the pressing of large plates up to several square metres superficial area, it is relatively difficult to distribute the material to be pressed so uniformly in the matrix that the pressed article will be everywhere of the desired wall thickness, density and strength. If the distribution of the mixture poured into the matrix be effected by hand or by means of an ordinary hand-operated implement, this will take a relatively long time. Moreover, it is not possible in this way to obtain an even approximately uniform distribution. These disadvantages are overcome by the invention.

According to the invention the material to be pressed is, before the application of pressure, uniformly distributed in the matrix by means of a special distributing device or by a suitable construction of the charging arrangement. These means enable a very rapid and extremely uniform distribution of the material in the matrix to be effected. In consequence, the wall of the pressed article will everywhere be of the desired thickness and of uniform density and strength.

According to the invention the uniform distribution of the material in the matrix may be effected by means of a grid formed of vertical partitions, which is adapted to be inserted in the matrix. The grid may be made in one or more pieces and may consist of any material, for instance short metal or pressed material. The walls of the grid may be so high that, after the insertion of the grid in the matrix, they will reach to the edge of the matrix. The upper edges or lower edges of the grid partitions may, according to the form of the work to be pressed, lie in a plane surface or a wavy or otherwise shaped surface. The partitions of the grid may be so formed and interconnected that cells are formed having a round or cornered, for instance a square, cross-section.

For distributing the material in the matrix, according to the invention, the grid consisting of the vertical partitions is first placed in the matrix and thereupon the material is poured into the cells formed by the partitions of the grid and is strickled off smoothly over the individual cells. The grid is then withdrawn again from the matrix. The pressing operation may then commence. The matrix may, however, first be partially filled, the grid then placed in position and the cells of the grid filled up.

As a device for uniformly distributing the material to be pressed, a plate may also be used in accordance with the invention, the size of which corresponds approximately to the size of the matrix and which is provided on its under side with a large number of pins. The plate and the pins may be made of any sort of material, for instance of metal or of a pressed substance. The device may consist of one or more parts.

For effecting a uniform distribution of the material in the matrix the plate set with pins is, after the material has been poured into the matrix and been strickled smoothly on its surface, placed on the poured-in material in such a manner that the pins penetrate into the material. Thereupon the plate with respect to the matrix or the matrix with respect to the plate or the matrix and plate with respect to one another is moved to and fro in a horizontal plane in one or different directions. During this relative motion of plate and matrix the material to be pressed is, by means of the pins provided on the under side of plate, loosened up and distributed very uniformly within the matrix. After the plate has been lifted off the pressing operation may commence. The relative motion between plate and matrix may be produced by hand or by power.

Furthermore, according to the invention, for the distribution in the matrix of the material to be pressed, an arrangement may be used which consists substantially of a container for receiving the material to be pressed and having one or more discharge openings at its lower end, in which openings one or more rotary rollers are mounted. The roller or rollers may be of round or cornered cross-section. With advantage the roller or rollers are displaceable transversely to their axial direction, so that the space between adjacent rollers or between the rollers and the walls of the discharge opening is adjustable. By this means the rate of discharge and the

amount of discharge of the material to be pressed can be regulated within optional limits. Another possible way of regulating this rate and quantity of discharge is by making the speed of revolution of the rollers regulable. In order to cause the material which is to be pressed reaching the rollers in uniform distribution, a worm or other moving device is with advantage mounted above the rollers, for instance a roller provided with cams or other elevations or depressions or with arms, blades or buckets. Such a moving device may also serve for loosening the material and for breaking up any lumps in the material. With advantage, the device will be made displaceable with respect to the matrix or the matrix with respect to the device or both with respect to each other in such a manner that the discharge opening will travel over the entire surface of the matrix.

According to the invention an endless conveyer band or a plurality of endless conveyer bands may in addition be interposed between the discharge opening and the matrix. In this case the conveyer band or the conveyer bands may be made displaceable with respect to the matrix or the matrix with respect to the conveyer band or the conveyer bands or both with respect to one another, so that the whole of the matrix is swept over by the place of delivery of the conveyer band. Preferably the speed of travel of the conveyer band or of the conveyer bands is made regulable within optional limits. The speed of revolution of the roller or rollers, the speed of travel of the endless conveyer band or of the conveyer bands and the speed of the relative motion of the matrix and the material container or of the matrix and the conveyer bands are so adjusted that the material to be pressed will be poured on to the various places of the matrix in proportion to the desired wall thickness of the pressed body at such place.

As the device for distributing the material in the matrix a device may also be used in accordance with the invention which consists substantially of a container for the reception of the material with one or more discharge openings and an endless conveyer band or a plurality of endless conveyer bands arranged between the discharge openings of the container and the matrix. With advantage, this device will be made displaceable with respect to the matrix or the matrix with respect to the device or both with respect to one another in such a manner that the discharge place of the conveyer band sweeps over the whole surface of the matrix. For this purpose the conveyer band or the conveyer bands can be made displaceable with respect to the matrix or the matrix with respect to the conveyer band or the conveyer bands or both with respect to one another. Preferably, the speed of travel of the conveyer band or of the conveyer bands is regulable within optional limits. The discharge opening of the box may be formed by the box being made without a bottom. The material to be pressed, which is poured from above into the box which is open at the top and bottom, will in this case bear directly on the conveyer band. For regulating the quantity of material emerging from the box, the box may be provided with an adjustable slide. When the box has no bottom the slide will preferably be arranged at that wall of the box which is the front one when viewed in the direction of motion of the conveyer band, and will be made vertically adjustable in such a manner that the material which is poured under the box on to the conveyer band is strickled off at the height desired in each case. Any other kind of device may, however, be used for regulating the quantity of material discharged.

Constructional examples of distributing devices according to the invention are illustrated in the accompanying drawings, in which:

Figure 1 is a plan view of a distributing device;

Figure 2 the front view of Figure 1;

Figure 3 a plan view of another distributing device;

Figure 4 the front view of Figure 3;

Figure 5 another distributing device in vertical longitudinal section;

Figure 6 the plan view of Figure 5;

Figure 7 a further distributing device in vertical longitudinal section;

Figure 8 the plan view of Figure 7;

Figure 9 a further distributing device in vertical longitudinal section, and

Figure 10 the plan view of Figure 9.

According to Figures 1 and 2, the distributing device consists of a grid made up of thin partitions **31**. These partitions enclose small cells **32**. The grid corresponds in its overall dimensions approximately to the size of the matrix. After the grid has been placed in the matrix the material to be pressed is poured into the cells **32** formed by the partitions **31** and is strickled off smoothly above the cells. The grid is thereupon lifted out of the matrix, after which the pressing operation may be carried out.

The distributing device according to Figures 3 and 4 consists of a plate **41** which is provided with pins **42** distributed uniformly over its surface. The plate **41** corresponds in its overall dimensions approximately to the size of the matrix. After the material to be pressed has been poured into the matrix and strickled off smoothly, the plate **41** is placed on the material in such a way that the pins **42** penetrate into the material. Thereupon the plate is moved to and fro in one or more directions with respect to the matrix or the matrix with respect to the plate or the matrix and plate with respect to one another, whereby the material is loosened up and distributed uniformly within the matrix. After the plate **41** has been lifted off the pressing operation may be carried out.

In the device according to Figures 5 and 6, a container **1** for the material to be pressed is provided, which is open at the top and is charged from above. At its lower end is the discharge opening **2**. In this discharge opening are arranged two oppositely rotating rollers **3** and **4**, the distance between which can be regulated. Above the rollers **3** and **4** is mounted a worm **5** which works in both directions, that is to say, is divided in the middle and operates from the middle towards both ends, and the distance of which from the rollers **3** and **4** is also adjustable. The speed of revolution of the rollers and the worm is regulable. The material to be pressed, which is poured from above into the container **1**, arrives in its passage through the said container first of all on the worm **5**, by which it is distributed to the two rollers **3** and **4**. Between these rollers the material to be pressed is then discharged to the outside through the discharge opening **2**. The container **1**, together with the rollers and worms mounted in it, can be moved as a whole with respect to the matrix **6** in such a manner that the discharge opening **2** sweeps over the whole of the matrix.

In the constructional form shown in Figures 7 and 8, the container **11** for the material to be pressed is provided at its right-hand bottom corner (see Figure 7) with a discharge opening **12**. In front of the discharge opening is mounted a roller **13** of square cross-section. The bearings of this rotatable roller **13** are engaged by a lever **14** which can be swung about a pivot **15** fixed on the container **11**. In its swinging motion the lever **14** is guided by means of a pin **16** in a sickle-shaped groove **17** and can be fixed in this groove by means of a wing nut or in any other manner. Below the container **11** travels an endless conveyer band **18** which is guided over two end rollers **19**, **20** and a guide roller **21**. The material to be pressed is poured from above into the container **11**. As it leaves the lower discharge opening **12** of the container it is uniformly distributed over the width of the conveyer band **18**. By adjusting the roller **13** the rate of discharge of the material can be regulated within optional limits. The roller **13** at the same time serves the purpose of loosening up the material as it emerges, of breaking up any lumps which may have formed and of throwing back any excess of material leaving the container. This roller **13** can be mounted within the container, in front of or above the discharge opening and outside the container behind the discharge opening. The conveyer band **18** can be displaced together with the end rollers **19**, **20** and the guide roller **21** above the matrix **22** in such a manner that the place of discharge of the conveyer band will sweep over the whole of the matrix. The conveyer band may be bounded on its sides by guide rails which prevent the conveyed material from falling off at the sides. By regulating the speed of revolution of the rollers **19** and **20** and of the roller **13**, the rate and quantity of charge can be varied within optional limits.

In the constructional form shown in Figures 9 and 10, the container of the distributing device consists of a box **51** which is open at the top and the bottom and which therefore has neither a cover nor a bottom. The material to be pressed is poured from above into the box **51**. The material passes through the box on to the endless conveyer band **52** which is guided over the rollers **53**, **54** and **55**. As the conveyer band reverses its direction around the roller **55**, the material to be pressed is discharged into the matrix **56**. The distributing device can be moved with respect to the matrix or the matrix with respect to the distributing device or both with respect to one another in such a manner that the discharge place of the conveyer band will sweep over the whole of the matrix. For regulating the amount of material conveyed by the conveyer band a slide **57** is provided at the front wall of the box, which slide can be raised and lowered by means of a handle **58**. The slide **57** is provided with two guiding slots **59** through which the screws **60** on the box engage. After these screws have been released, the slide can be set to any height and be fixed by tightening the screws. By displacing the slide **57** in the vertical direction the opening **62** in the front wall of the box **51** can be uncovered to the extent desired in each case.

CUSTAV ADOLF HASEKE.

PUBLISHED

PRIL 27, 1943.

BY A. P. C.

G. A. HASEKE
MANUFACTURE OF PLATES OF LARGE
SUPERFICIAL AREA
Filed May 16, 1939

Serial No.
273,993

5 Sheets-Sheet 1

Fig.1

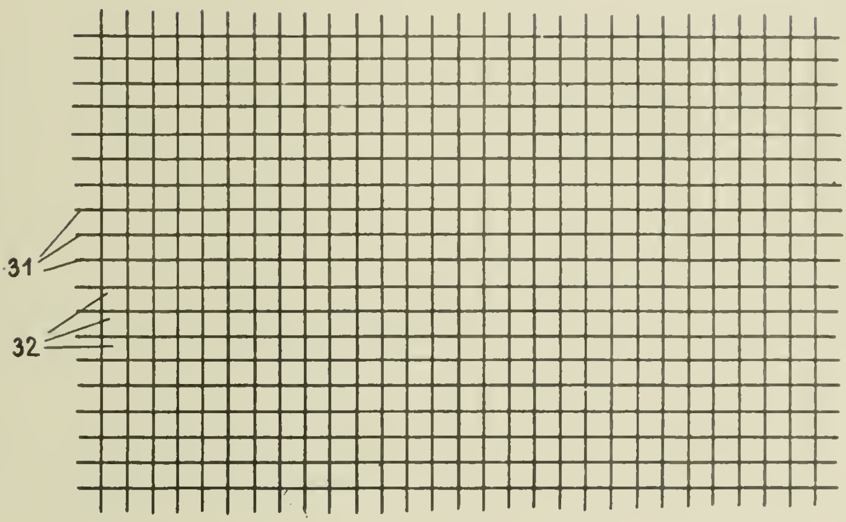

Fig.2

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PUBLISHED

APRIL 27, 1943.

BY A. P. C.

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MANUFACTURE OF PLATES OF LARGE
SUPERFICIAL AREA
Filed May 16, 1939

Serial No.
273,993

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Fig.3

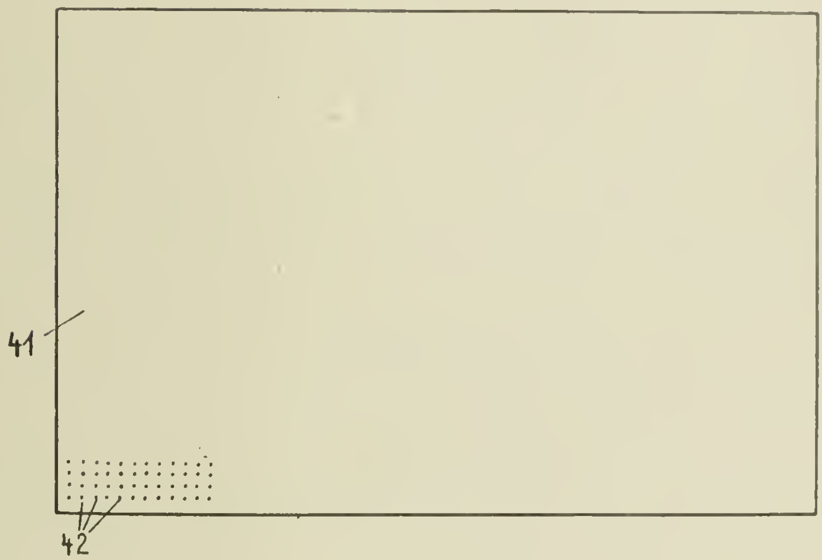

Fig.4

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PUBLISHED
APRIL 27, 1943.
BY A. P. C.

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MANUFACTURE OF PLATES OF LARGE
SUPERFICIAL AREA
Filed May 16, 1939

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Fig.5

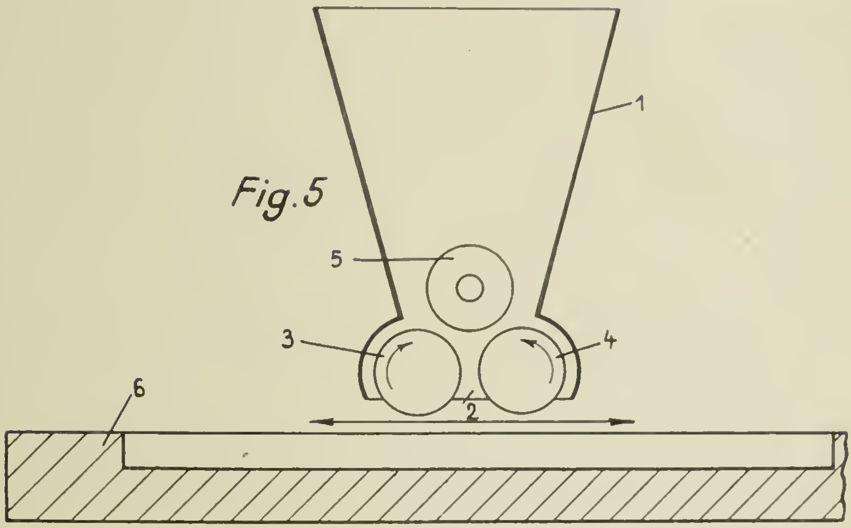
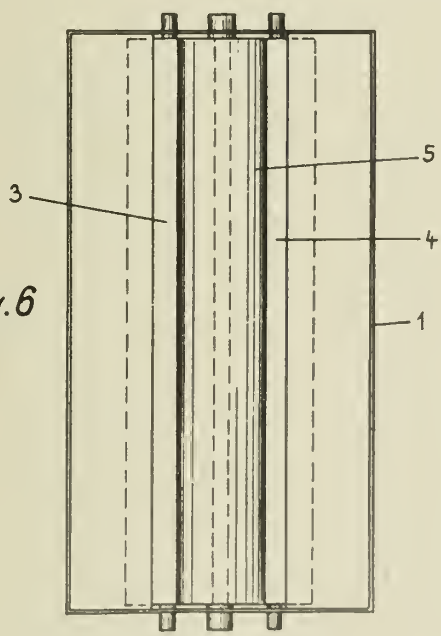


Fig.6



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APRIL 27, 1943.

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MANUFACTURE OF PLATES OF LARGE
SUPERFICIAL AREA
Filed May 16, 1939

Serial No.
273,993

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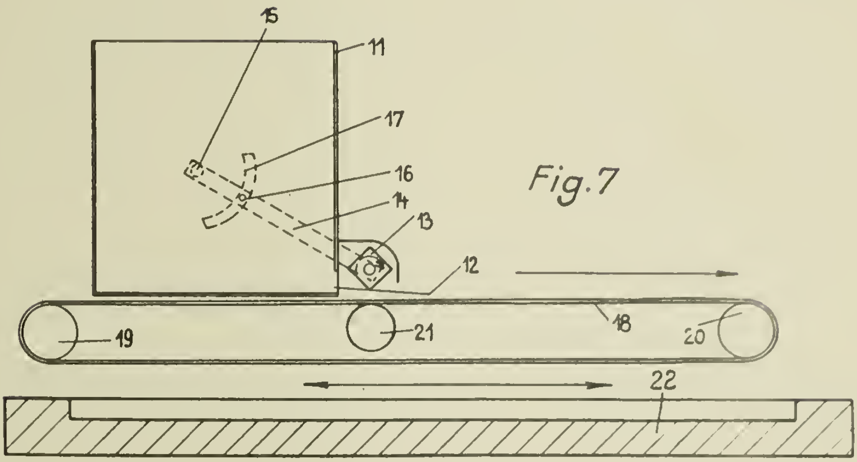
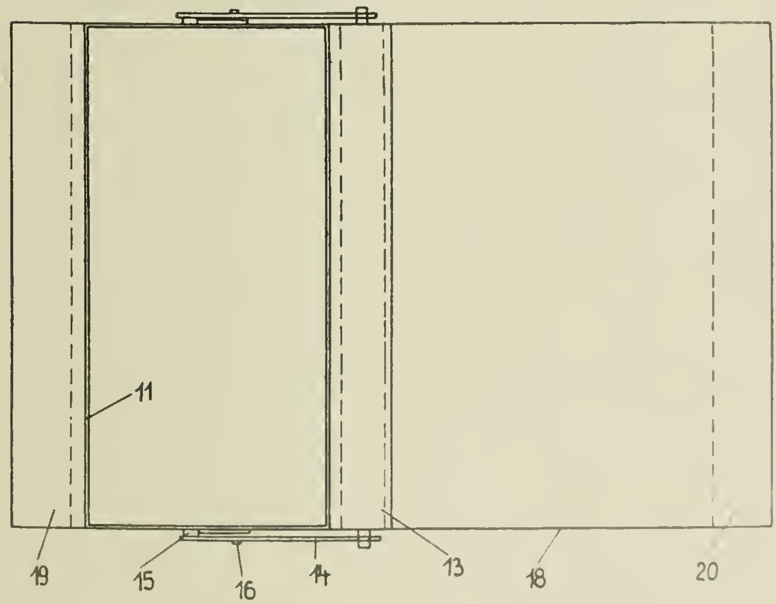


Fig. 7

Fig. 8



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MANUFACTURE OF PLATES OF LARGE
SUPERFICIAL AREA
Filed May 16, 1939

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273,993

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Fig.9

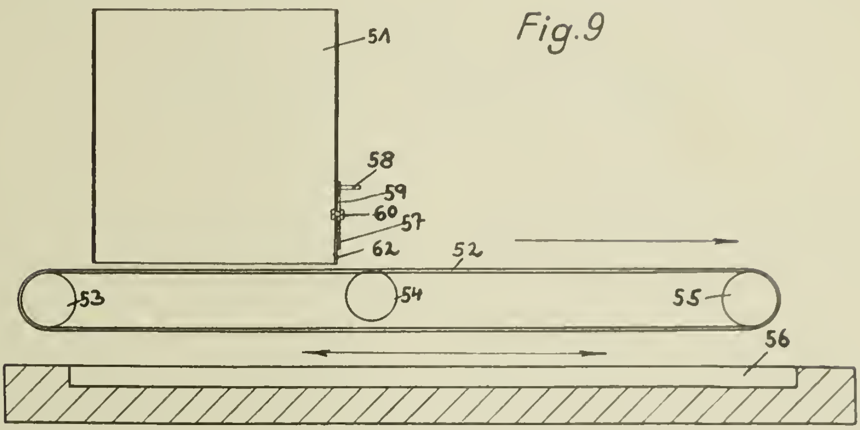
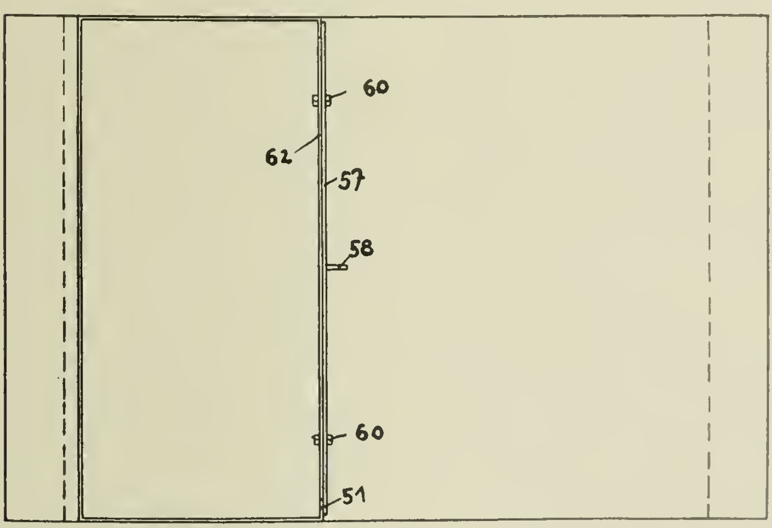


Fig.10



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Published Apr. 27, 1943

Serial No. 275,082

ALIEN PROPERTY CUSTODIAN

PISTON RINGS AND METHOD OF MAKING SAME

Tetsutaro Hiromi, Yodobashi-Ku, Tokyo, and Ryozo Yanagida, Nihonbashi-Ku, Tokyo, Japan; vested in the Alien Property Custodian

Application filed May 22, 1939

This invention relates to piston rings of uniform stress and the manufacture thereof, and has for its object to provide improved piston rings which may be simply and cheaply made and which shall exert substantially uniform pressure on the wall of a cylinder.

Although not limited to its application thereto, the invention is particularly applicable to piston rings of relatively large size for use in connection with Diesel engines, steam engines, compressors and the like.

It is known to make a pitson ring by first preparing a blank having a greater diameter than that of a finished ring, cutting away a portion of the blank to produce a suitable gap, then reducing the diameter of the blank by clamping it until the gap disappears, holding the ends of the blank firmly together by means of a pin or the like, finishing the periphery to the desired diameter and then removing the pin.

Known piston rings constructed in this manner present the serious disadvantage that the parts secured together by the pin will no longer be able to change the curvature, and, moreover, if the pin were improperly forced in, there would be no remedy for correcting it.

Since scores or scratches are made in the cylinder wall mostly where the ends of the piston ring make sliding contact with the wall of the cylinder, such parts of the ring must be worked and finished with the greatest possible care. As a result of research, we have found that a piston ring which was made by bringing together the cut ends carelessly and working the periphery without permitting any free displacement at the ends, as is the case with the known practice, does not show, in the finished product, a uniform curvature and if such a ring is placed in a cylinder the pressure exerted by the ring is not uniformly distributed in the cylinder wall but is liable to become even negative at one end (See the pressure distribution curve shown in Figure 1 of the accompanying drawings).

The main object of this invention is to provide a method which will yield piston rings in which this drawback is obviated or substantially reduced.

According to this invention, a piston ring of uniform stress is produced from a ring blank having a greater diameter than that required in the finished product by cutting away a portion of the metal to make a gap, forming a hooked scarf by means of which the gap is closed tangentially and finishing the periphery to the desired diameter.

By the invention, the cut ends engage with other simply by means of a scarf joint, so that the jointed ends are not firmly secured together but are allowed to make free displacement while moreover, the clamping operation is so simple and easy that no harmful force can be introduced during the clamping operation. Even if the ring blank were incorrectly clamped, the ends would automatically slide relatively to each other, thereby taking the free form. Re-clamping is also possible at any time, since the ends engage simply by means of a hooked scarf. When the ends are thus engaged and the periphery of the ring is finished in this condition to the desired diameter, the resultant product will exert substantially uniform pressure on the cylinder wall with which it engages.

The invention is illustrated in and further explained in connection wtih the accompanying drawings, in which:

Figure 1 is a diagram showing the varying stress distribution in the ring manufactured by the known method;

Figure 2 is a perspective view of a ring blank with the milling cut made therein for forming a hooked scarf according to this invention;

Figure 3 is an front elevation of the blank with the cut ends engaging with each other; and

Figure 4 shows three modifications of the finished ring gap.

In carrying out the invention, a portion of a ring blank 1 is cut away to make a gap, and hooks 2,2 are formed in the cut ends, as shown in figure 2, preferably by a milling operation. The gap is then closed by tightening a clamping belt or the like which is wound around the blank body 1, so that the hooks 2,2 engage with each other to form a scarf joint, as shown in figure 3. After removing the belt, the blank 1 is attached to a face-lathe or the like whereby its periphery is finished to the desired diameter. If the ring is to be finished in two steps, then the ring as above treated is re-clamped by a belt to a uniformly stressed condition in which it is again submitted to a finishing operation. If such a process is repeatedly carried out, the stress distribution in the ring will be greatly improved.

The hooked ends of the blank are finally finished by means of a file or the like to produce the gap form required in the finished piston ring. Three forms of the gap are shown in figure 4 Thus.

The ring of which the hooks are filed off to such an extent that the tips 2',2' no longer engage with each other, as shown in A of figure 4.

is substantially air-tight at this point and, therefore, may be used in compressors, but not in heat engines.

The ring of which one hook is filed away, as shown in B of figure 4, is suitable for use in all sort of engines.

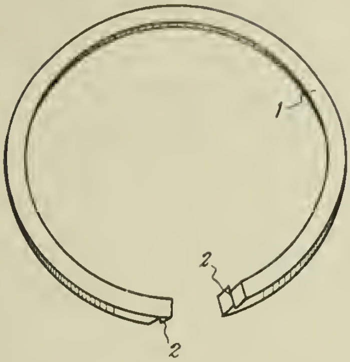
The ring of which the hooks are filed flat as shown at 2'',2'' in C of figure 4 and the faces *a* and *b* finished suitably, will maintain a gap of a suitable width when inserted in the cylinder and, therefore, is suitable for use in high heat engines. This form of ring is obviously more air-tight than the known ring having a simple diagonal gap, and also is less susceptible to carbon deposit than those having a gap of the "lap" type.

TETSUTARO HIROMI.
RYOZO YANAGIDA.

PUBLISHED
APRIL 27, 1943.
BY A. P. C

T. HIROMI ET AL
PISTON RINGS AND METHOD OF MAKING SAME
Filed May 22, 1939

Serial No.
275,082



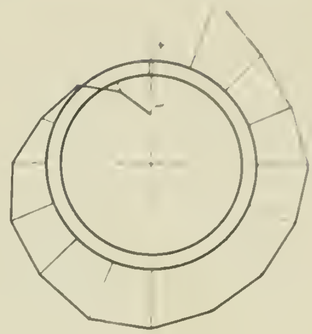


Fig. 3

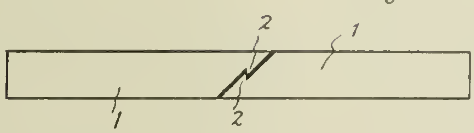
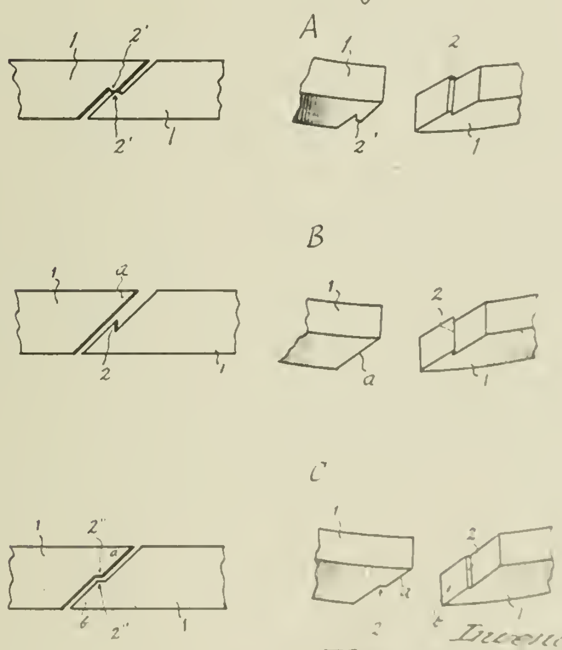


Fig. 4



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Published Apr. 27, 1943

Serial No. 275,121

ALIEN PROPERTY CUSTODIAN

METHOD OF PRODUCING INSULATING MATERIAL FROM GLASS

Bernard Weiner, Prague, Bohemia-Moravia; vested in the Alien Property Custodian

Application filed May 22, 1939

It has been known for a long time that when ground glass, to which gas separating substances have been added, is heated, a foamy mass, the sponge glass, is formed, which retains the foamy structure even after cooling down, provided suitable precautions are taken.

Such suitable precautions are the various known manufacturing methods, which prevent the bubbles from collapsing during cooling.

There is in existence, for example, a method wherein the glass powder is heated in moulds, which are subjected to greater or less pressure during cooling.

Other manufacturing processes are based on the use of certain substances and on effecting the heating and the subsequent cooling repeatedly.

Finally, a further method consists in heating ground glass with an addition of certain substances in tightly closed moulds, which lend to the product its final form.

The method of manufacture according to the invention consists in that powdered glass mixed with gas separating substances is heated in a large tightly closed container of fire-resisting steel. This container has a narrow opening or openings which may be closed. At the stage where the glass becomes foamy inner superatmospheric pressure is produced in the tank, for example by introducing compressed air into the tank, or in some other suitable manner. The effect of this superatmospheric pressure is that when the openings are simultaneously opened the sponge glass formed in the tank, being still quite soft, is forced out through these openings. Under the opening or openings vessels or forms are moved along, in which the extruded sponge glass is collected. The temperature under the container is lower than the temperature in the container. The comparatively large bubbles formed in the container are reduced in size during the extrusion through the openings, i. e. they are compressed, so that the pressure in the bubbles (superpressure) is higher than would correspond to the temperature. Owing to the fact that the mass of the sponge glass enters into a lower temperature, first this superpressure and then the solidification of the walls of the bubbles prevents same from collapsing. The size of the bubbles obtained depends upon the size of the opening or openings.

An embodiment by way of example is shown in the accompanying drawing.

In the incandescent zone of the tunnel furnace A a container B is disposed, which is licked by the combustion gases. The container B has a feed pipe C through which the material is introduced and a tube D for introducing the compressed air. Through the opening E the sponge glass passes into containers disposed on the endless band F under the container B. For uninterrupted operation a plurality of containers may be disposed side by side or one behind the other, the containers being charged and discharged at intervals.

At a further stage of production the shapes of insulating material may be provided with a coating of glass. This may be done by causing the containers or moulds into which the extruded sponge glass is introduced to pass under the scraper G and then under the container H, from which easily meltable glass is caused to flow or is sprayed upon the surface of the products and thus forms a coating of glass thereon. In another method for obtaining a coating of glass on one side of the product the containers or moulds are provided at the bottom prior to pouring in the sponge glass with liquid glass, which welds together with the sponge glass upon filling.

In any case it is necessary to paint or spray the vessels or moulds prior to filling with a suitable material, for example clay, kaolin or the like, which prevents the material from adhering to the vessels or moulds.

BERNARD WEINER.

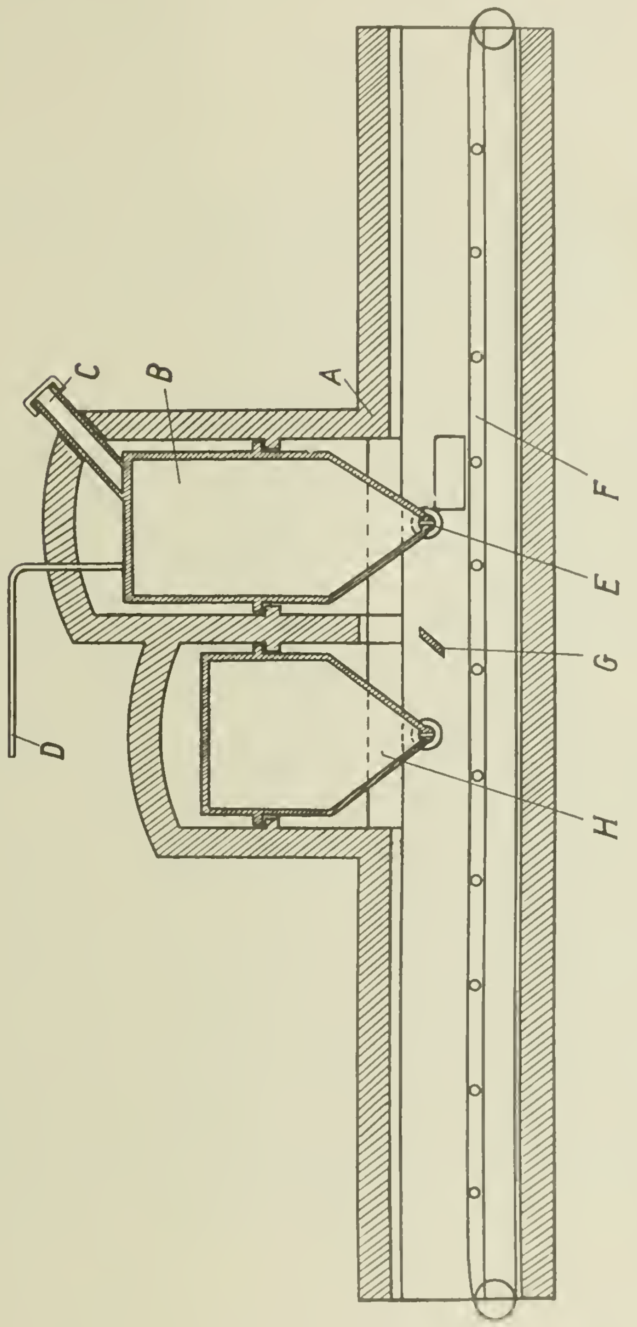
PUBLISHED

APRIL 27, 1943.

BY A. P. C.

B. WEINER
METHOD OF PRODUCING INSULATING
MATERIAL FROM GLASS
Filed May 22, 1939

Serial No.
275,121



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Published Apr. 27, 1943

Serial No. 275,357

ALIEN PROPERTY CUSTODIAN

SECURING THE HEADS TO THE CYLINDERS OF INTERNAL COMBUSTION ENGINES

Theodor Helmbold, Munich 27, Germany; vested in the Alien Property Custodian

Application filed May 24, 1939

Usually light metal cylinder heads are secured to the cylinder barrels of internal combustion engines, especially in connection with air-cooled aircraft engines, by shrinking them thereon.

It has now been found that the connection formed in this way leads to an irregular seating which has far reaching deleterious effects. One of the most essential thereof is that the heat transmission necessary for this purpose is considerably impaired at the point of connection. This in turn causes at this point inadmissible high temperatures, which may become so high, that burning occurs. Further, as a result of these local accumulations of heat the anti-knock value suffers, whilst the running properties on the cylinder wall are deleteriously influenced at this point.

All these phenomena, especially the unsatisfactory influencing of the combustion operation in the cylinder result in an unsatisfactory efficiency which is felt in a partcularly disadvantageous manner in connection with modern aircraft engines with their high utilisation of power.

As a remedy the invention proposes to provide the cylinder heads alone or these and the cylinder barrels at the point of connection, before the shrinking, with a coating of a metal of which the melting point is below the shrinking temperature, for example with a coating of tin.

This metal, which during the shrinking is molten, fills all the irregularities of the shrunk seating, that is to say all the points at which there is not obtained the necessary intimate metal closure between the two cylinder parts as a result of the shrinking, and thus produces an uniform and rapid transmission of heat from the cylinder running surface to the cooling ribs of the cylinder head part, which is fitted over the cylinder barrel at the point of connection, whereby all the deleterious phenomena, which have occurred at the point of connection of the head and barrel in connection with cylinders assembled by the previous method, and with which there is associated a poor transmission of heat, are eliminated.

In the accompanying drawings Figs. 1 and 2 show vertical sections of a cylinder barrel and cylinder head, in Fig. 1 before the head is applied to the barrel and in Fig. 2 after the head has been applied to the barrel.

The cylinder barrel **1** is made at its upper end with two cylindrical surfaces **2** and **3** provided above and below of a thread **4**, whilst the corresponding female thread **4'** and also the bores **2'** and **3'** are provided in the cylinder head **5**. Between the contacting surfaces of the cylinder barrel **1** and the cylinder head **5** is a layer **6** of an easily fusible metal, for example tin as shown in the drawings (thickness of layer exaggerated in order to show clearly its position) in such a manner that either the cylinder barrel is given a coating of tin or both the cylinder barrel and the cylinder head. After both parts being connected, the space between the contacting surfaces of both parts is filled with the layer **6**.

THEODOR HELMBOLD.

PUBLISHED

APRIL 27, 1943.

BY A. P. C.

T. HELMBOLD
SECURING THE HEADS TO THE CYLINDERS
OF INTERNAL COMBUSTION ENGINES
Filed May 24, 1939

Serial No.
275,357

Fig. 1

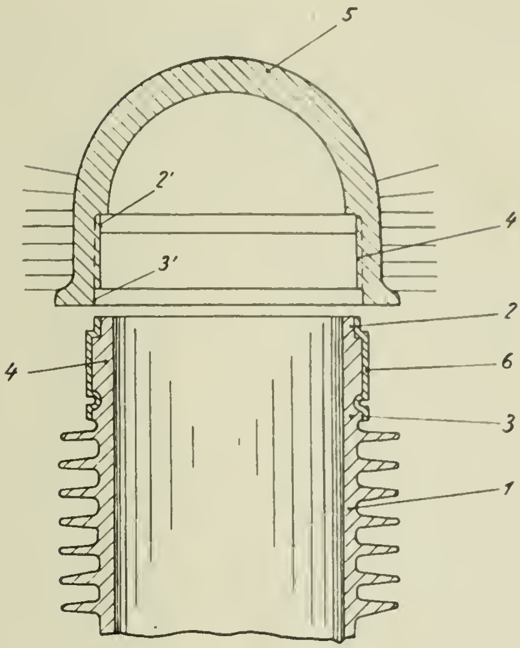
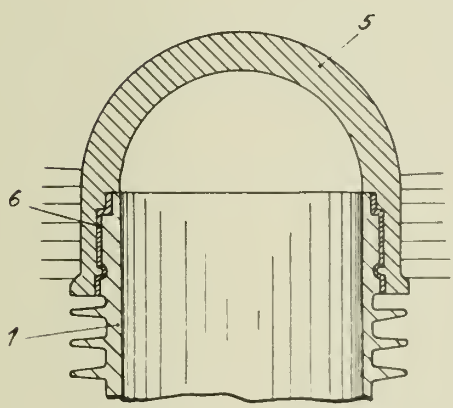


Fig. 2



INVENTOR:
TH HELMBOLD

ATTORNEYS

Published Apr. 27, 1943

Serial No. 275,399

ALIEN PROPERTY CUSTODIAN

DYEING CELLULOSE ESTERS

Robert Schnegg, Dormagen, Germany; vested in the Alien Property Custodian

No Drawing. Application filed May 24, 1939

The present invention relates to the art of dyeing cellulose esters, and more especially, to a process for dyeing shaped articles like fibres, films, bands, and so on of highly acetylated cellulose, i. e. cellulose acetate having an acetate content of above 59%; such cellulose acetates are for the most part soluble in chloroform.

It is known that highly esterified cellulose acetate is not easily dyed even with such dyestuffs which are usually employed in dyeing the lower cellulose acetates. The same holds true when trying to increase the affinity of highly esterified cellulose acetate towards other dyestuff classes, for instance, acid wool dyestuffs by animalizing. This great resistance of highly esterified cellulose acetate to all kinds of dyestuffs is presumably due to the fact that the articles manufactured therefrom possess a rather horny surface free of pores which would allow the dyestuff particles, which are mostly high molecular, to wander into the interior.

It is known that similar difficulties, but on a lesser scale, are encountered when dyeing common acetate artificial silk which is less highly esterified and is soluble, not in chloroform, but in acetone, and that it has been tried to overcome the difficulties by adding certain swelling agents to the dye-baths for such artificial silk.

However, when trying to apply the processes used in dyeing acetone-soluble acetate artificial silk to the problem in question, the result is not successful. It was rather unexpected, therefore, when I found that nevertheless also articles from highly esterified cellulose acetate can be very easily dyed when the articles are previously brought into a highly swollen condition and are dyed in this state. In order to achieve this result, I have found it to be necessary to treat the articles with at least 40% aqueous acetic acid or a swelling agent of at least equal swelling action; furthermore, it is preferable to carry out this swelling treatment at high temperatures, for instance, temperatures of above 50° C. It may be noted that under such conditions the common acetone-soluble artificial silk is completely dissolved or at least destroyed to an extremely high degree. Contrary thereto, the mechanical properties of the articles of highly esterified cellulose acetate, for instance, resistance to break and elongation at break, are practically unimpaired by the present process.

After the treatment with one of the swelling agents, the articles can be dyed directly in deep and full shades; the dyeings so obtained have good fastness properties. It is especially possible to dye animalized articles after the said swelling treatment with acid wool dyestuffs and to obtain dyeings of excellent fastness. Before dyeing, the swelling agent may be removed from the articles by washing with water, without practically losing the property of being easily dyed. This property is only lost when the articles are dried before dyeing.

I have now furthermore found that by a suitable treatment it is even possible to dry the articles having been treated with one of the above strong swelling agent in a manner that they retain the property of being easily dyed. In order to achieve this result, I treat the articles which have been brought into the strongly swollen condition, if desired after removal of the swelling agent by washing, with a fixing agent selected from the group consisting of aqueous solutions of salts of organic or inorganic acids and wetting agents, which are free from sulphonic acid groups; these fixing agents may be employed alone or in admixture with each other. Apparently by this treatment the swollen condition of the cellulose acetate articles which is necessary for their being easily dyed is fixed to some extent. After the said fixing treatment the articles may be dried. They remain easily dyeable thereafter and may be stored for any length of time or shipped to the customer without being impaired with regard to their dyeing properties. If before or during dyeing the fixing agents are washed out from the articles, the cellulose acetate will again pass into the unswollen state whereby the dyestuff particles are very strongly fixed in the interior of the material so that the dyeings produced in this way show excellent fastness properties. For instance, dyeings with acid wool dyestuffs on animalized cellulose material having been produced according to my invention are faster in many respects, for instance, against fulling and washing than the same dyeings on wool. As I have mentioned in several instances, the process according to my invention is of special value in dyeing animalized material of highly esterified cellulose acetate with acid wool dyestuffs. Such material is produced in known manner, for instance, by incorporating basic substances like nitrogen bases with the material, for instance, by adding a suitable nitrogen base to a spinning solution for artificial fibres from highly acetylated cellulose. It is possible in this way, for example, to prepare artificial fibres from cellulose having an acetic acid content of above 59% which can be dyed alone or together with wool in equal shades as wool. For example, cellulose

triacetate fibres are prepared which contain a basic nitrogen containing resin, the fibres are treated with at least 40% aqueous acetic acid or a swelling agent of similar strength, are then treated with one of the above mentioned fixing agents and thereupon dyed with an acid wool dyestuff. The fibres may then be worked up into a mixed fabric together with wool and, by aftertreating with the same dyestuff, may be uniformly dyed. It is self-understood that in a similar way two-colored effects may be produced. It is furthermore possible to work up animalized cellulose triacetate fibres together with wool to slivers, yarns, skeins, fabrics and so on, and to treat these materials with a swelling agent which will not impair the wool. Thereupon the materials may be dyed in one on the same bath in uniform shades with acid wool dyestuffs. As above mentioned the fastness of the dyeings on the cellulose acetate articles surpass that of the same dyeings on wool, especially as regards the fastness to washing and fulling.

Of course the process is also applicable to textile printing. For instance, a fabric from cellulose triacetate fibres or animalized cellulose triacetate fibres may be printed with one of the above strong swelling agents and thereupon may be dyed with a suitable dyestuff, if desired, after having been treated with one of the said fixing agents. In both cases dyed patterns on a white ground or vice versa may be obtained.

Example 1

Fibres which have been prepared from chloroform-soluble cellulose acetate (acetic acid content: 59–61%) according to a wet-spinning process are continuously passed through a bath containing 60% aqueous acetic acid. The fibres swell strongly. Thereupon the fibre bundle is deacidified by washing with water and dyed with a water insoluble cellulose acetate dyestuff. By using, for instance, Cellit Fast Blue B (Schultz, Dyestuffs Tables, 1st suppl. vol., 1934, page 75), a deep blue shade is obtained whereas without the said swelling treatment the fibres are practically not dyed.

When trying to treat common acetate artificial silk (acetic acid content: 54–55%) in the same way, the fibres are completely dissolved.

Example 2

Fibres swollen and washed as described in example 1 are cut into staples and brought into a bath containing 10–30% of an inorganic or organic salt. The following salts, if their solubility permits so, may be used: chlorides, bromides, iodides, sulfates, nitrates, borates, phosphates, sulfites, thiosulfates, thiocyanates of the alkali and alkaline-earth metals, furthermore, alkali and alkaline-earth metal salts of the lower fatty acids, and mixtures of the said salts. After the swollen fibres have been treated for 5–10 minutes in a salt bath, for instance, a 20% solution of common salt, they are centrifuged and dried. After shortly washing the fibres are dyed as usual with celculose acetate dyestuffs, for instance, Celliton Fast Black BTN (Schultz, Dyestuff Tables, 1st suppl. sol., 1934, page 76). Contrary to the untreated fibres, they are dyed in deep and full shades.

The usual softening and finishing agents may be added to the salt bath.

Example 3

Instead of a salt bath as described in the foregoing example, there may be used an aqueous solution of 5-50 g per litre of a wetting agent which is free from sulphonic acid groups, for instance, a reaction product of a reactive tertiary amine with the anhydride of a substituted succinic acid, or a condensation product of oleyl alcohol or of castor oil with an excess of ethylene oxide.

Example 4

Fibres having been subjected to a swelling treatment as described in example 1 are aftertreated with a bath containing 2–10% of a salt and 0.05–0.5% of wetting agent which is free of sulphonic acid groups. The results are similar to those obtained according to examples 1–3.

Example 5

Cellulose acetate artificial silk (acetic acid content: 59%) prepared by a dry spinning process is treated in skein form for 15–120 seconds at a temperature of 30° C in a 50% aqueous acetic acid. After having been washed with water, the silk is dyed with Celliton Fast Black BTN in a deep black shade, whereas the untreated silk is hardly dyed. Of course, it is possible to add an aftertreatment of the swollen fibres as described in examples 2–4.

Example 6

To a raw solution of cellulose triacetate, there are added 5–15% (calculated on cellulose acetate) of a reaction product of starch benzene sulfonate with an amine as described in the application Ser. No. 180,157, filed December 16, 1937, and the solution is spun into fibres. In spite of the presence of the nitrogenous compounds, these fibres are but scarcely dyed with acid wool dyestuffs.

The fibres are then continuously passed through a bath containing 60% aqueous acetic acid at a temperature of 20° C for 15–120 seconds, thereupon washed with water and are dyed, while still wet, with acid wool dyestuffs, for instance, Amido Yellow E (Schultz, Dyestuffs Tables, vol. 1, 1931, No. 16). The deep dyeings obtained in this manner are especially distinguished by their fastness. For example, the fastness against fulling is 4–5 (Normen der Deutschen Echtheitskommission 1935), whereas a corresponding dyeing on wool has a fastness against fulling of 1–2. A series of other acid wool dyestuffs act in the same way, for instance, Quinoline Yellow (Schultz, Dyestuffs Tables, vol. I, 1931, No. 918), Brilliant Crocein B (Schultz, Dyestuff Tables, 1st suppl., vol., 1934, No. 539), Alizarine Rubinol R. (Schultz, Dyestuff Tables, vol., I, 1931, No. 1210), Wool Fast Violet B (Schultz, Dyestuff Tables, vol. I, 1931, No. 974), Alizarine Direct Blue A (Schultz, Dyestuff Tables, vol. II, 1932, page 9), Azo Acid Black 3 BL special (Schultz, Dyestuff Tables, 1st suppl. vol., 1934, page 70), and so on.

Example 7

A solution of cellulose triacetate in glacial acetic acid is mixed with an animalizing agent, for instance, a reaction product of chlorinated paraffin with ethylene diamine, and is spun by the wet-spinning process; the fibres obtained therefrom are swollen in a 60% aqueous acetic acid at 60° C for 15 seconds washed with water, and treated for 5 minutes in a salt bath containing 5% sodium acetate, 2% ammonium thiocyanate, 2% of a finishing agent and 0.5% isododecenyl-succinic acid-diethyl amino-methyl ester. The centrifuged and dried fibre is excellently dyed by acid wool dyestuffs.

Example 8

A fibre bundle of cellulose triacetate being animalized as described in example 6 is swollen for 30 seconds at a temperature of 10° C in a 65% aqueous acetic acid which contains about 2% of a chromium compound, for instance, sodium bicromate or chromium acetate and, if desired, a reduction agent like formaldehyde or glucose. The bundle is freed from acid and cut into staples. The fibres are after-treated in a salt bath (containing 8% sodium acetate, 1% of a wetting agent free of sulfo groups and 2% of a usual preparation), dried and worked up with wool to a yarn or textile fabric. The mixture is uniformly dyed with acid wool dyestuffs. Especially suitable are chromable dyestuffs. The dyeings on the artificial fibres are not only of the same fastness to washing, fulling and perspiration, but are equal to the dyeings on pure wool regarding the fastness to light.

Example 9

Triacetate artificial silk containing an animalizing agent is worked up with wool in the relative proportion 1:1. The mixture is treated in a bath containing 60% aqueous acetic acid and 2% glucose for 15 seconds at 20° C, centrifuged, washed and dyed in the wet state with wool dyestuffs such as, for example, Anthralane Blue B (Schultz, Dyestuff Tables 1st suppl., vol., 1934, page 68). The dyeings obtained are uniform on both kinds of fibres. Dyeings of particular fastness are obtained by using salts of the acid sulfuric acid esters of leuco vat dyes, which also dye both kinds of fibres equally and with the same fastness properties.

Example 10

On working as described in example 9, but inserting, after the swelling, a salt treatment, similar dyeings are obtained as those of example 9.

Example 11

A fibre produced as described in example 8 is dyed with a water-insoluble cellulose acetate dyestuff, for instance, a Celliton Fast Dyestuff. By the presence of the animalizing substance, the affinity of the triacetate against such dyestuffs is not as one should have believed, diminished, but even considerably increased, so that, for instance, the dye baths are almost completely exhausted and the dyeings are deeper than on acetate artificial silk having an acetic acid content of 54–55%.

Example 12

Fibres of chloroform-soluble cellulose acetate produced by the dry- or wet-spinning process are locally printed with 60% aqueous acetic acid, if desired, in the presence of a thickening agent and thereupon dyed, or treated with salt and after drying dyed with cellulose acetate dyestuffs at 70–80° C. Thereby fibres are obtained which show interesting two-colour effects, because the untreated places do not or practically not absorb the dyestuff, whereas the treated fibres absorb the same very strongly.

Example 13

Fibres of triacetate having incorporated therewith an animalizing agent are spun and treated as described in example 12. Flamed fibres may be obtained with cellulose acetate dyestuffs or with acid wool dyestuffs, chrome dyestuffs and so on.

Example 14

A fabric prepared of cellulose triacetate fibres is printed in patterns with a paste containing 65% aqueous acetic acid, washed and dyed, or washed, treated with a salt as described in example 7 and then dyed. With suitable dyestuffs, for instance, with Cellit Fast Blue B, dark patterns on a white ground are obtained.

Example 15

A fabric of triacetate artificial silk having incorporated an animalizing agent is printed as described in example 14. On dyeing with cellulose acetate dyestuffs, similar effects as in example 14 are obtained. By dyeing with acid wool dyestuffs or with chrome dyestuffs which reserve acetate silk, coloured patterns on a white ground are obtained.

ROBERT SCHNEGG.

Published Apr. 27, 1943

Serial No. 276,724

ALIEN PROPERTY CUSTODIAN

STAPLING MACHINES

Franz Muske, Bremen-Sebaldsbruck, Germany; vested in the Alien Property Custodian

Application filed May 31, 1939

This invention relates to wire stapling machines of the type in which a continuous length of wire is fed to the machine and is bent and cut to form individual staples, which are then inserted into the workpiece.

An object of the invention is to provide a machine of this type which is flexible and versatile in operation, so that the size of the staples and angular orientation at which they are inserted into the workpiece can be varied by a quick and simple adjustment.

A further object of the invention is to provide a machine of improved construction with a plurality of stapling heads in which the staples can be inserted longitudinally, that is, in line with the row of stapling heads.

A still further object of the invention is to provide a machine with a plurality of stapling heads in which the positions of the individual heads can be independently and easily varied to suit requirements.

A still further object of the invention is to provide a stapling machine of generally improved construction, which shall be robust and efficient in operation.

Broadly stated, in my invention I employ a stapling head in which the staple can be rotated after being formed and before being inserted, so that it can be formed in one plane and inserted in another. In this way it is possible to employ stapling heads placed very much more closely together than was previously possible when stapling longitudinally. It is also possible to adjust the orientation at which the staples are inserted to suit requirements.

These and other advantages which result from my invention will be more fully understood from the description which follows, in which one particular form of stapling machine is described by way of example and with reference to the accompanying drawings, in which:

Figure 1 is a front view of the machine;

Figure 2 is a section on the line A—A in Figure 1;

Figure 3 is a longitudinal section through a former and driver shown on a larger scale;

Figure 4 is a similar view to Figure 3, showing the former in another position;

Figure 5 is a similar view, showing the position of the parts just before the staple is driven in;

Figure 6 is the same view as Figure 5, showing the device when used for transverse stapling;

Figure 7 is a section on the line B—B in Figure 3;

Figure 8 is a section on the line C—C in Figure 4;

Figure 9 is a section on the line D—D in Figure 5;

Figure 10 shows a staple after it has been bent to shape.

The frame of the machine comprises two upright members 2, 2′, supported on a base plate 1 and joined by a transverse member 3, on which the stapling heads 4 are slidably mounted. A table 5, which is arranged below the stapling heads 4, can be adjusted in height by means of a hand wheel 6. The workpiece into which the staples are to be inserted is placed upon the table 5.

Two driving plates 7 and 8 are mounted above the transverse member 3 so that they can slide vertically between the two uprights 2, 2′. The plate 7 is provided with a groove 9, and the plate 8 with a groove 10. The plate 7 is provided at its upper end and on each side with lugs 11, 11′, which are pivotally connected to the links, 12, 12′. The links 12, 12′, are in turn pivotally connected to the levers 13, 13′, the other ends of which are held on a shaft 14 which is rotatably mounted in the uprights 2, 2′. The driving plate 8 is provided with lugs 15, 15′ corresponding to the lugs 11, 11′. These lugs are connected through links 16, 16′, to levers 17, 17′, which are also mounted on the shaft 14.

Guide rollers 18 and 19 are respectively attached to levers 13, 13′, and 17, 17′, and engage the cam tracks 20 or 21 as the case may be, which are provided in the cam plates 22 and 22′.

The cam plates 22 and 22′ are secured to a shaft 23, on which is secured an arm 24. This arm is coupled by means of a rod 25 to a crank 26 on the shaft 27. A clutch device 28 is arranged on the shaft 27 and is provided with a control member 29. A gear wheel 30, which is rotatable about the clutch device 28, meshes with a pinion 31, which is secured to the driving shaft 32, which is in turn driven by a pulley 33 which can be brought into or out of engagement by means of a clutch 35 operated by a hand lever 34.

The control member 29 can be released by means of a a foot lever 36. This causes the clutch 28 to come into engagement so that the gear wheel 30 rotates the shaft 27 through one revolution. On completion of one revolution, provided that the foot lever 36 has in the meantime been released, the control member 29 again comes into operation to interrupt the drive between the gear wheel 30 and the shaft 27.

Each stapling head comprises a cylinder 37 (as

best shown in Figure 3), in which a former 38 can reciprocate. The former 38 is provided with a head 39 which is held by, but rotatable in, the groove 10 of the driving plate 8. The former is also provided with a slot 40, the lower part of which runs axially whilst the upper part is spiral in form. A roller 41 runs in the slot 40 and is secured in a slot 42 in the cylinder 37. The former 38 at its lower end is provided with a further slot 43. This slot is reinforced on either side by means of inserts 44, which are hardened on their outer surfaces and in which axial grooves 45 are formed. The driver of the stapling head is in the form of a member 46 which can reciprocate between the inserts 44 and the driven end of which passes out through the former 38 and carries a head 47 which is held by, but rotatable in, the groove 9 of the driving plate 7. The lower end of the driver 46 is provided with longitudinal ribs 48, which run in the grooves 45 of the inserts 44. A staple support 49 is mounted in the groove 43 of the former 38 so as to rock about an axis 50. The lower and longer half of this support is broadened to the shape shown, and the upper and shorter half is acted on by a spring 51. A cavity 52 in the lower part of the inner wall of the cylinder 37 exerts a cam action on the upper part of the support 49 during the downward movement of the former 38.

A catch 53 is rotatably mounted on the cylinder 37 and has a curved nose which enters the slot 43 and a rear end which coacts with an abutment 54, the height of which can be adjusted.

As shown in Figure 2, the stapling head 4 carries a rearwardly extending arm 55 on which a reel 56 is mounted. A wire 57, which unwinds from the reel, is cut up and bent to form the staples of the shape shown in Figure 10 under the reference numeral 58. A bracket 59 is arranged below the arm 55 and carries several rolls 60 and a feeding mechanism 61 which grips the wire and advances it bit by bit. A cutting device 62 is located in front of the feeding mechanism 61 and comprises a lower fixed blade and an upper moving blade. Channels 63 are provided in the cylinder 37 and lie in the direction of the wire. An abutment 64 is arranged in front of these channels and its position can be adjusted by means of the screw 65 in accordance with the desired length of the end of wire which is to be cut off.

The wire feeding mechanism 61 is driven by means of an arm 66 which is splined to the shaft 67, which is journaled in the uprights 2, 2'. One end of this shaft carries a crank 68 connected to a rod 69. In order to be able to adjust the stroke of the feeding mechanism, the crank 68 is provided with a slot, in which the position of the end of the rod 69 is adjustable. The other end of the rod 69 is secured to a cam plate 71 driven by clutch plates 72, 72' which form a friction coupling. The plates 72, 72', are carried on the shaft 23.

The operation of the machine is as follows:

The requisite number of stapling heads 4 are mounted on the transverse member 3 at the desired intervals, the heads 39 of the formers 38 being inserted in the groove 10 of the driving plate 8 and the heads 47 of the drivers 46 being inserted in the groove 9 of the driving plate 7. The table 5 carrying the workpiece into which the staples are to be inserted is then adjusted to the required height. If longitudinal stapling is required, i. e. if the staples are to be inserted in the workpiece in a vertical plane parallel to the front of the machine, the position of the roller 41 is adjusted until it approximates to that shown in Figure 3.

To begin the stapling operation, the foot lever 36 is depressed, which releases the control member 29, so that the shaft 27 and the crank 26 rotate through one complete revolution. The drive is transferred by means of the rod 25 and the arm 24 to the cam plates 22 and 22', which rock the levers 13, 13' and 17, 17', in accordance with the contours of their cam tracks 20 and 21. This causes the driving plates 7 and 8 to undergo a corresponding movement, so that the formers 38 and, independently, the drivers 46 of all the stapling heads are simultaneously driven. In the initial position shown in Figure 3, an end of wire which has already been cut off, lies symmetrically across the nose of the catch 53. The former 38 is now pressed downwards into the position shown in Figure 4, during which movement the projecting ends of wire are engaged by the inserts 44 and bent downwards, the two bent ends which form the two limbs of the staple lying in the grooves 45 of the inserts.

So far the position of the catch 53 has been determined by the abutment 54, and no rotation of the former 38 has taken place. The abutment 54 is now removed, which causes the catch 53 to move clear of the former 38 (as shown in Figure 5) and during further downward movement of the former 38 the support 49 rocks into the slot 43 between the limbs of the staple which are lying in the grooves 45. This movement of the support 49 occurs automatically as a result of the short upper end of the support entering the cavity 52 under the action of the spring 51. During this further downward movement of the former 38 the roller 41 enters the spiral part of the slot 40 and thus causes the former 38 to rotate through 90°. On completion of this operation, the former 38 is in the position shown in Figures 5 and 9, in which the staple has rotated through 90° from its original position.

The staple 58 is now inserted by means of the driver 46, which is forced downwards at this point. During this operation, the support 49 is deflected sideways. On completion of the stapling operation, all the parts return to their initial position and the drive is interrupted by means of the foot lever 36.

If transverse stapling is required, i. e. if the staples are to be inserted in a vertical plane at right angles to the front of the machine, the position of the roller 41 is adjusted to that shown in Figure 6, where the roller is fixed at the bottom of the slit 42 so that during the stroke of the former 38 the roller does not enter the spiral part of the slot 40. Thus, no rotation of the former 38 takes place, so that the staple is inserted without alteration in its orientation, i. e. while lying in a vertical plane at right angles to the front of the machine.

By appropriate adjustment of the roller 41 in the slot 42 any desired orientation of the staple can be achieved. As can be clearly seen from Figures 3 to 6, it is perfectly easy to arrange for the staple to be rotated through more than 90° by continuing the spiral slot further.

Besides the common driving plates for the formers and for the drivers, additional ones can be provided for other members, e. g. for the cutting mechanisms and the catches 53. These additional driving plates can also be controlled by cam slots in the cam plates 22, 22'.

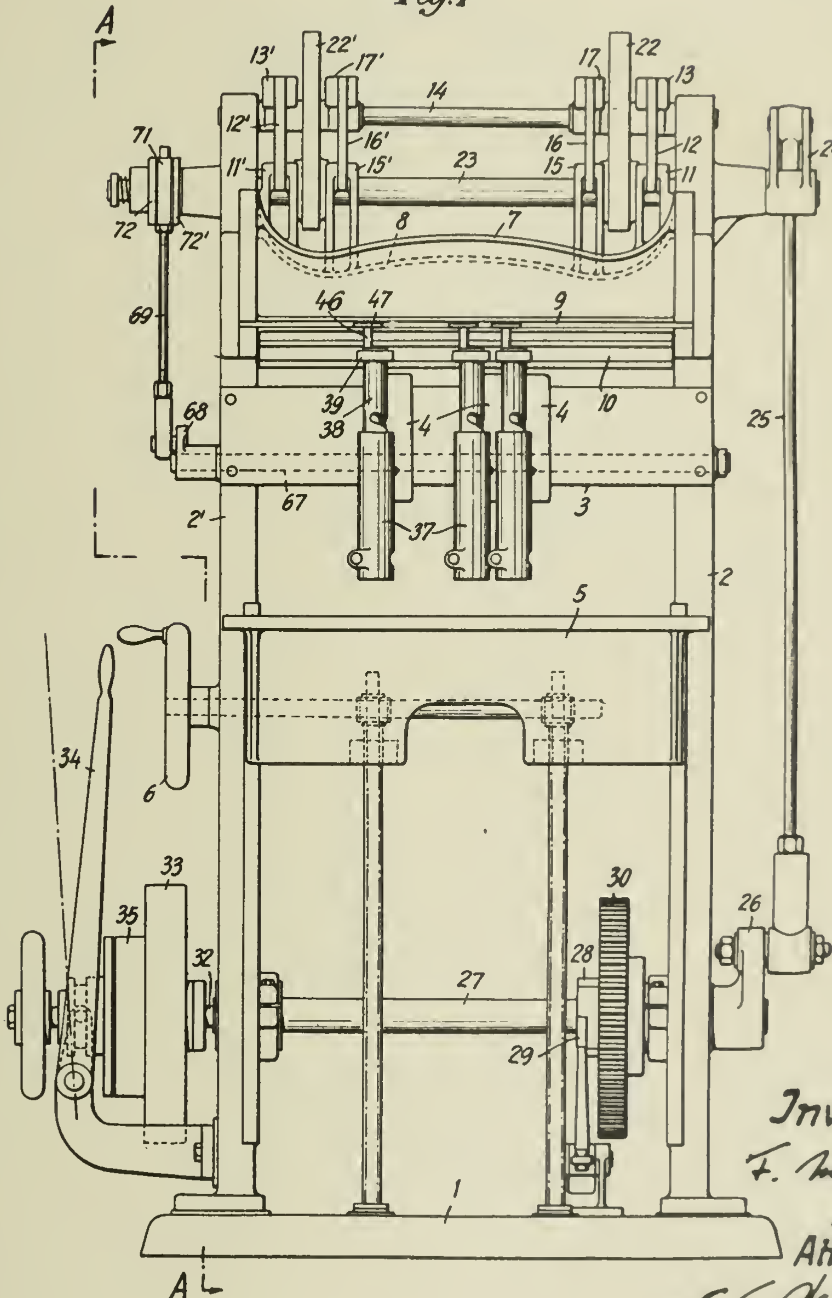
It is clear that by using the machine described

many advantages are obtained. It is possible to staple longitudinally while using a large number of stapling heads arranged close together, so as to give a stitching effect. This was impossible with previous continuous wire fed machines, since the wire feeding mechanisms prevented the heads from being placed close together when stapling longitudinally. Other obvious advantages result from being able to adjust the number and position of the stapling heads and the orientation at which the staples are inserted, in such an easy and simple manner.

FRANZ MUSKE.

PUBLISHED	F. MUSKE	Serial No.
APRIL 27, 1943.	STAPLING MACHINES	276,724
BY A. P. C.	Filed May 31, 1939	3 Sheets-Sheet 1

Fig.1



Inventor:
F. Muske
By
Attorney:
E. F. Wenderoth

PUBLISHED
APRIL 27, 1943.
BY A. P. C.

F. MUSKE
STAPLING MACHINES
Filed May 31, 1939

Serial No.
276,724
3 Sheets-Sheet 2

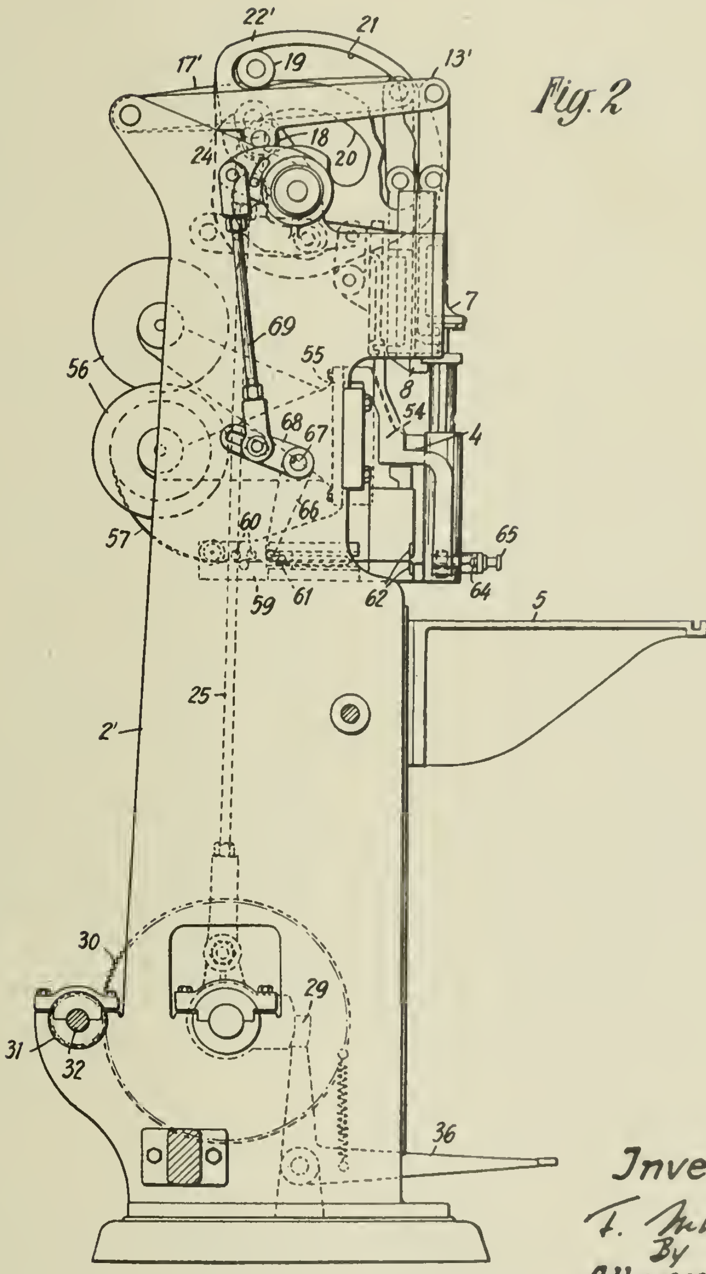


Fig. 2

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PUBLISHED	**F. MUSKE**	**Serial No.**
APRIL 27, 1943.	STAPLING MACHINES	**276,724**
BY A. P. C.	Filed May 31, 1939	3 Sheets-Sheet 3

Fig. 3

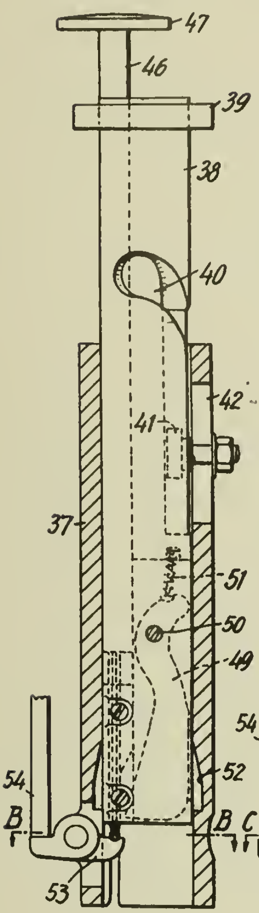

Fig. 4

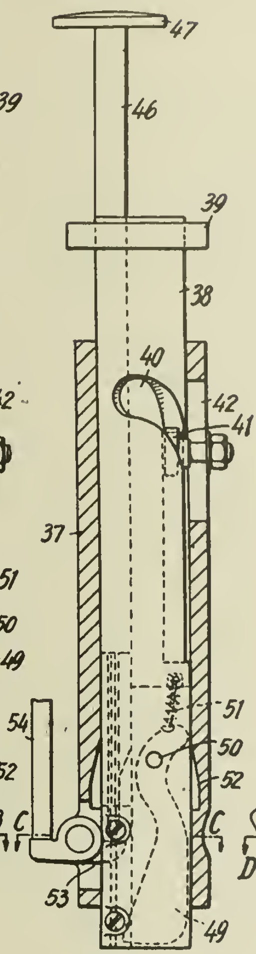

Fig. 5

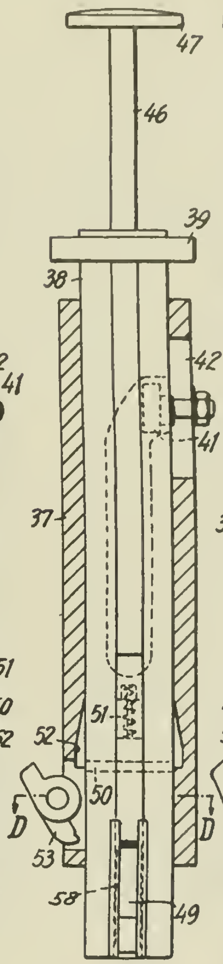

Fig. 6

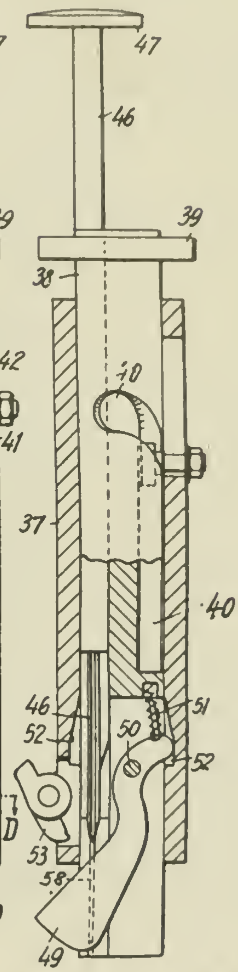

Fig. 7

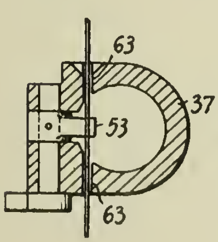

Fig. 8

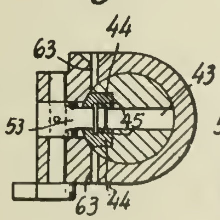

Fig. 9

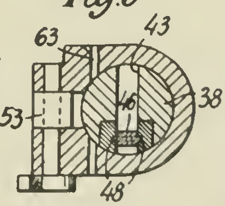

Fig. 10

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Published Apr. 27, 1943 Serial No. 277,306

ALIEN PROPERTY CUSTODIAN

BAND OF TEXTILE FABRIC ADAPTED FOR HAVING CLOSURE ELEMENTS SUCH AS PRESS-BUTTON CLOSURE ELEMENTS PRESSED INTO THE SAME, OR PROVIDED WITH SUCH PRESSED-IN CLOSURE ELEMENTS

Jean Persin, Paris, France; vested in the Alien Property Custodian

Application filed June 3, 1939

It is known to provide bands of a textile fabric with press-button closure elements, e. g. in the case of detachable shirt cuffs. It has been found, however, that the places where the said elements are attached to the band, will show a great deal of wear and that the band, particularly when shirts and cuffs are treated in the washing machine will be torn to pieces.

The present invention has for its purpose to obviate the said drawbacks. The essential feature of the said invention resides in the fact that the band is provided in a longitudinal direction with one or more stripe-shaped portions which have a greater tensile strength than the remainder of the band. This greater strength may be obtained by using stronger warp threads for the said portion(s). It is not necessary that the threads in question are thicker, if only they are stronger. The said greater strength may also be obtained by using a larger number of warp threads per unit of width of the band. The said methods of reinforcement may also be used in combination with each other. In the case of bands for shirt cuffs use will be generally made of a reinforced longitudinal central stripe which stripe will then bear the press button elements. For other purposes the closure elements may be located on an eccentric longitudinal stripe or on a plurality of such stripes. The stripe(s) may be provided with an inscription.

The band may be of any desired kind of textile fabric, e. g. of silk or figured satin cotton etc. or of a combination of different materials. Warp and weft may be different. It may be provided with rounded or other selvedges. In a band with a reinforced longitudinal central stripe the warp may consist for example of 156 double warp threads, of which 36 in the center are of No. 60/2 and colored, while 120 other warps are of No. 80/2 and uncolored. The weft may then be formed over the entire length by glazed cotton threads No. 60/2, 32 per cm. This only serves by way of a single example.

The invention is still more fully explained with the aid of the drawing representing an embodiment of the same.

JEAN PERSIN.

PUBLISHED

APRIL 27, 1943.

BY A. P. C.

J. PERSIN

BAND OF TEXTILE FABRIC ADAPTED FOR HAVING CLOSURE ELEMENTS SUCH AS PRESS-BUTTON CLOSURE ELEMENTS PRESSED INTO THE SAME, OR PROVIDED WITH SUCH PRESSED-IN CLOSURE ELEMENTS

Filed June 3, 1939

Serial No. 277,306

Fig. 1.

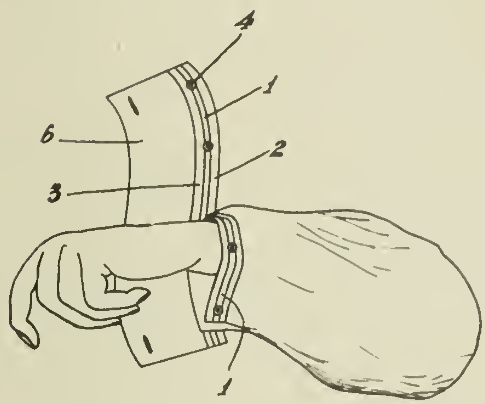
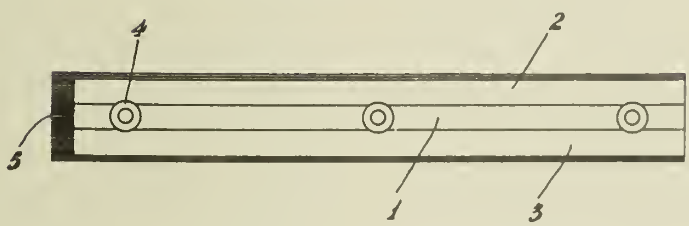


Fig. 2.



Inventor:
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Published Apr. 27, 1943

Serial No. 277,955

ALIEN PROPERTY CUSTODIAN

PROCESS FOR MANUFACTURING ARTIFICIAL FIBER FROM PROTEIN CONTAINED IN SOY-BEAN

Toshiji Kajita and Ryohei Inoue, Tokyo, Japan; vested in the Alien Property Custodian

No Drawing. Application filed June 7, 1939

This application is a divisional of our application Ser. No. 162,954, filed Sept. 8, 1937.

This invention relates to a process of manufacturing artificial fibre from protein contained in soya-bean, and consists in extracting the protein, with dilute alkaline solution, from the residue of the soya-bean after the oil content has been extracted. The protein is then precipitated by adding acids or metallic salts to said solution. The precipitate is washed with water, allowing a suitable amount of water to remain with the precipitate. A stabilizer such as sugar or tartaric acid is added thereto and then the mixture is dissolved in alkaline solution. The resulting solution is then allowed to mature after which the solution thus obtained is spun into an acid bath which may contain suitable organic coagulating agents. The object of this invention is to produce artificial fibre of a superior quality which does not degenerate and to provide an economical and efficient process of manufacturing such fibres.

The advantages of our invention may be more fully understood from the following description. In the present invention a stabilizer such as sugar or tartaric acid is added to the precipitate obtained from the extraction solution above described and the mixture is then dissolved in alkaline solution, the resulting solution being allowed to mature and the solution thus obtained is spun into an acid bath which may contain suitable organic coagulating agents. By the addition of the stabilizer such as herein mentioned, the oxidation or decomposition of protein can be prevented during the process, especially during the step of maturing. Moreover while the spinning solution is maturing, a homogeneous solution is obtained and the spinning can be easily carried on. The resulting fibre does not degenerate and a very pliant touch as well as an excellent dying ability is obtained. In manufacturing a fiber from a spinning solution prepared by dissolving the protein of the soya-bean in alkaline solution to which sugar or tartaric acid have not been added and which is not submitted to maturing, the protein is oxidized and decomposed during the process and consequently the filament is broken during the spinning step and continuous spinning cannot therefore be carried on. Moreover, the fiber thus obtained is very hard and brittle and consequently of no practical use.

One example of carrying out the invention into practice is as follows:

The residue of soya-bean from which the oil content has been extracted and containing 40 to 47% of protein is subjected to extraction with an alkaline solution diluted 5 to 10 times by weight, for example, 0.2 to 2% of ammonia solution or caustic alkaline solution at the temperature of 20° to 30° C., for about 2 to 5 hours, whereby the protein amounting to 10 to 20% of the total amount of the raw material may be extracted. The protein thus obtained is purified by adding a dilute solution of hydrogen peroxide or sodium peroxide and bone charcoal or China clay and then filtered. To the transparent solution thus obtained a solution containing 10 to 15% of acids such as acetic acid, sulphuric acid, phosphoric acid, etc., or a 30 to 40% aqueous solution of metallic salts of acids, for example, copper sulphate, zinc sulphate, zinc acetate, copper acetate is added and until the solution becomes weakly acidic, whereby the protein or proteic salt is precipitated. The precipitate thus obtained is thoroughly washed with water to remove adhering salts and acids and separated by filtering. Then sugar or tartaric acid is added as a stabilizer at the rate of 0.2 to 0.5% to said precipitate which contains 75 to 85% of water and subsequently said mixture is well mixed and kneaded in an alkaline solution of 25 to 40% concentration which corresponds to 3 to 7% of the protein content whereby a colloidal solution is produced. Then by filtering and removing bubbles, and maturing the said solution at the temperature of 10° to 20° C. for 2 to 3 days, a spinning solution is obtained. This spinning solution is then spun in the usual manner or allowed to fall into an acid bath of 10 to 50% concentration or an acid bath containing in addition 10 to 20% of an organic coagulating agent such as alcohol, formaldehyde, acetone, etc., and then submitted to the finishing procedure.

According to the present invention, a proteic artificial fibre of superior quality resembling wool or natural silk which does not degenerate can be obtained.

TOSHIJI KAJITA.
RYOHEI INOUE.

Published Apr. 27, 1943

Serial No. 277,956

ALIEN PROPERTY CUSTODIAN

PROCESS FOR MANUFACTURING ARTIFICIAL FIBER FROM PROTEIN CONTAINED IN SOY-BEAN

Toshiji Kajita and Ryohei Inoue, Tokyo, Japan; vested in the Alien Property Custodian

No Drawing. Application filed June 7, 1939

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The advantages of our invention may be more fully understood from the following description. In the present invention a stabilizer such as sugar or tartaric acid is added to the precipitate obtained from the extraction solution above described and the mixture is then dissolved in alkaline solution, the resulting solution being allowed to mature and the solution thus obtained is spun into an acid bath which may contain suitable organic coagulating agents. By the addition of the stabilizer such as herein mentioned, the oxidation or decomposition of protein can be prevented during the process, especially during the step of maturing. Moreover, while the spinning solution is maturing, a homogeneous solution is obtained and the spinning can be easily carried on. The resulting fiber does not degenerate and a very pliant touch as well as an excellent dying ability is obtained. In manufacturing a fiber from a spinning solution prepared by dissolving the protein of the soya-bean in alkaline solution to which sugar or tartaric acid have not been added and which is not submitted to maturing, the protein is oxidised and decomposed during the process and consequently the filament is broken during the spinning step and continuous spinning cannot therefore be carried on. Moreover, the fiber thus obtained is very hard and brittle and consequently of no practical use.

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According to the present invention, a proteic artificial fiber of superior quality resembling wool or natural silk which does not degenerate can be obtained.

TOSHIJI KAJITA.
RYOHEI INOUE.

Published Apr. 27, 1943

Serial No. 278,768

ALIEN PROPERTY CUSTODIAN

PROCESS AND INSTALLATION FOR THE MANUFACTURE OF SHAPED METAL PRODUCTS

Robert Mautsch, Brussels, Belgium; vested in the Alien Property Custodian

Application filed June 12, 1939

The present invention relates to a process for the manufacture of shaped metal products, particularly of shaped metal products of small cross-section, from large metal pieces, in which process use is made of rolling mills to transform the large pieces into shaped sections.

By the expression "shaped products of small cross-section" must be understood, in the present application, not only metal products of more or less complicated sections commonly called "sections" in rolling mill practice, but also products of round, square or rectangular section, as also wires. It should be noted in this respect that one of the principal objects of the invention is in particular to produce wires, that is to say, of shaped sections of great length and of small cross-section, which in the present state of the art cannot be directly obtained by rolling from large pieces.

Hitherto, in order to obtain shaped products of small cross-section and in particular rods for wire drawing the metal is usually cast into ingots which are passed through a rolling mill, generally termed blooming, to transform them into blooms. These are heated again before being passed through a fresh rolling mill in order to obtain billets which must also be heated before passing them through another rolling mill where they are transformed into rods for wire drawing.

Sometimes instead of commencing with cast ingots, large masses are used resulting from the cold compression of metal scrap such as turnings from lathes. These masses are then heated to the welding point of the scraps and then rolled and heated again successively until obtaining the desired section.

The present invention has for its principal object to reduce the cost of the profile products particularly of those of small cross-section by avoiding these successive heatings and rollings.

To this end, according to the process of the invention, the large pieces above mentioned are cut into long and fine elements which are passed before they become oxidised, between rollers similar to rolling mill cylinders producing at their exit a continuous faggot.

This process has the advantage of permitting the sections desired to be obtained in a short time and much more cheaply than by the process of the reduction in section of the large starting pieces by heating and successive rollings alone. Furthermore, the cost of an apparatus for carrying out this process only represents a small part of the cost of the present apparatus.

This process also permits of using as the initial material all kinds of large pieces, even those generally considered as scrap. For example, the scrap of ingots and of large bars can be used. There may also be used large scrap such as the plates of old ships, axles, transmission shafts, and the like, suitably cleaned.

The process according to the invention permits of obtaining in a continuous and regular manner a metallic product of quite definite composition, which is not the case when blooms are rolled which result from the compression of dirty and oxidised scrap to which must be added substances intended to correct the defects caused by the impurities which soil the scrap used.

With a view to permit the regular and uniform supply of the compressing rollers, it is proposed, in the case of rolling of long and fine elements whose length is nevertheless relatively short in comparison with the length of the said continuous faggot, to deliver directly into a hopper serving for the feed of the first cylinders, fine and long elements cut from large initial pieces.

According to an additional and very advantageous feature, the long and fine elements are arranged in parallel to each other before being passed between the cylinders which agglomerate them into bundles.

The bundle obtained by the process described above, may be used as added metal for welding.

It may also be used as the electrode in an electric furnace where it is desired to obtain a metal or alloy of a perfectly definite composition.

There may also be obtained a section iron having a great mechanical strength by heating the bundle to a temperature sufficient to permit the welding of the elements by compression and by compressing the bundle thus heated in such manner as to ensure this welding by its passage between rollers similar to rolling mill cylinders. In particular for the manufacture of wires, the shaped section obtained by compression whilst hot of the bundle of small cross-section is drawn in such manner as to form a wire.

The invention has also for its object an apparatus particularly adapted for carrying out the process to which reference has been made just above.

According to the invention this apparatus comprises at least one machine arranged in such manner that the long and fine metallic elements which it cuts can pass by gravity into a hopper serving for the supply with long and fine metallic elements to rollers which are similar to rolling mill cylinders and which compress these elements into a bundle.

In order to permit of the easy regulation of the composition of the shaped product of small section, there is provided for each machine for cutting the large pieces into long and fine elements, means for regulating the quantity of these cut up elements.

According to a simple, cheap and strong embodiment, the cutting up machines comprise tools having an alternating movement.

The invention has also for its object a particular manner of realising the process according to the invention, this particular manner being intended to facilitate the manufacture of shaped products in comparison with the case of rolling of cut elements of relatively short length compared with the length of the shaped product obtained. This particular manner enables moreover to ameliorate when desirable the electric conductibility in comparison with the case where use is made of cut elements of relatively short length.

According to this particular manner, elements obtained by cutting are rolled, the length of the elements being such that they extend over the entire length of the finished shaped product.

According to an advantageous embodiment of the invention, a single cut element having a cross-section approximately equal in area to that of the desired profile is rolled.

In this way, there is obtained, even by cold rolling, particularly in the case of a ribbon-like element formed of soft steel, a shaped product of noteworthy mechanical properties.

It may be employed in particular either alone or in juxtaposition to other similar shaped products, for the production of the tubular covering of welding bars formed in manner known per se as a tubular covering produced by winding one or more ribbons and containing other materials, generally in pulverulent form.

In cases where a single cut element having a cross-section approximately equal in area to that of the desired shaped product is rolled, this element is preferably so cut that it has a cross-section of a form approximating to that of the desired shaped product.

In this way, bars of solid section for welding may be directly manufactured by cutting followed by cold rolling.

In cases where hot rolling is carried out, it is preferable to effect the hot rolling immediately after the cutting so as to utilise the heat evolved by the cutting of the elements.

In cases where the cut element is electrically heated by the Joule effect, the heating is carried out up to the point of the rolling, so that the maximum temperature is only reached at the point where the rolling commences.

Further features and details of the invention will appear from the description of the drawings attached to the present specification, which show diagrammatically some constructional forms of apparatus suitable for carrying out the process according to the invention.

Figure 1 is an elevation of an installation according to the invention with vertical section of the upper part of this apparatus.

Figure 2 is a view in perspective on a larger scale and with parts broken away, of a portion of the apparatus according to Figure 1.

Figure 3 is a cross-sectional view in perspective of a tool with which are equipped the cutting machines shown in Figures 1 and 2.

Figures 4 and 5 are respectively a view in elevation and a view in plan of the tool according to Figure 3.

Figures 6, 7 and 8 show as in Figure 1, three other embodiments of an apparatus according to the invention.

Figure 9 shows apparatus for the manufacture of a continuous wire from a single metal piece.

Figure 10 shows apparatus for the manufacture of continuous metal bands from two metal pieces.

Figure 11 shows apparatus for manufacturing metal bands of limited length from a single metal piece.

In these different figures, the same reference characters have been employed for identical elements.

Figure 1 shows an apparatus particularly adapted for carrying out the invention. In this apparatus large pieces such as **2** constituted for example by blooms or large scrap pieces are cut up by means of machines comprising tools with alternating movement.

The cutting machine shown is operated by a motor **3** the shaft **4** (Figures 1 and 2) of which carries a bevel pinion **5** engaging with another bevel pinion **6** keyed on to a crank shaft **7**. This crank shaft has three cranks **8** to each of which is coupled a connecting rod **9** attached to a tool carrier **10**. Each of the latter is guided rectilinearily in a guide **11** and carries a tool **12** pivoted at **13**.

The shaft **4** also carries an endless screw **14** engaging with a helicoidal wheel **15** keyed on to a shaft **16**. There are keyed on to the latter three stepped pulleys **17** over each of which passes a belt **18** running on the other hand over a stepped pulley **19**. The different pulleys **19** are mounted freely on a shaft **20** and are integral with grooved wheels **21**. Each piece **2** to be cut up is held between a grooved wheel **21** and another similar wheel **22**. Its feed is therefore continuously controlled by the motor **3**.

To prevent the tools **12** rubbing against the pieces **2** on their return stroke, they are made to pivot about their pivotal point **13**, owing to the fact that knobs **23** constantly forced outward by springs **24**, bear against bands **25** arranged laterally. The pivoting of the tool **12** in the direction corresponding to their movement away from the pieces **2** to be cut up is limited by a stop **26** on the tool carrier and against which bears a projection **27** on the tool. This control of the pivoting movement of the tool **12** is much simpler than the positive control which has been proposed in machines such as shaping machines to cause the pivoting of the tools under similar circumstances.

In principle, to cut long and fine elements by means of a reciprocating tool, it is proposed to use a tool provided with two cutting edges **28** (Figures 3, 4 and 5) each comprising fine teeth such as **29** disposed adjacently in such a manner that the projections of the said teeth partly overlap each other parallel to the transverse direction with respect to the direction of feed of the piece to be cut. In order words, if the arrow X of Figures 1, 2, 3 and 5 represents the direction in which the piece to be cut moves horizontally, the transverse direction to the direction of feed of the piece to be cut is represented by the double arrow Y of Figures 3, 4 and 5. It will be seen that the faces **35** (Figures 4 and 5) of the teeth **29** which are parallel to the direction of the arrow Y are partly concealed by one another when viewed in the direction of feed X of the piece to be cut, due to the fact that the faces **30**

of these teeth form acute angles with the faces 35.

The general direction of each of the cutting edges of the reciprocating tool shown in Figures 3, 4 and 5 is oblique relatively to the plane in which the piece to be cut moves. This follows particularly from Figure 4.

In fact, this figure is a view in elevation of the tool and the lower toothed edge of the latter is oblique relatively to the horizontal plane in which the piece to be cut moves.

If the tool had a single cutting edge it would give rise to a lateral thrust of the piece 2 to be cut, in one or other of the directions indicated by the double arrow Y. With a view to preventing this thrust, the two cutting edges are symmetrically inclined relatively to the direction of feed X of the piece to be cut.

In other words, the two cutting edges 28 of the tool form together a V, the plane of symmetry of which is parallel to the direction of feed X of the piece to be cut. In Figure 5 which is a view in plan, it will be seen clearly that the two cutting edges 28 form a V the plane of symmetry of which is parallel to the horizontal direction of feed X of the piece to be cut.

In practice, a tool is used the operative parts of which are detachable. In order to avoid the necessity of a precise positioning of each operative part without having to fear the formation of an uncut strip at the bottom of the V if the operative parts are not sufficiently close together, one of the operative parts is arranged so that its cutting edge is at a different level from that of the cutting edge of the other operative part, and the operative part the cutting edge of which is at a higher level than that of the cutting edge of the other operative part is caused to penetrate into the other operative part so that the projections of the cutting edges intersect in the direction of movement of the tool.

In Figures 3 and 4 it will be seen that the operative part 31 of the tool is cut at 32 at a certain distance from its cutting edge and that a part 33 of the other operative part 34 of the tool penetrates the operative part 31, so that the projections of the cutting edges are superposed, as shown in Figure 5 in the direction of movement of the tool, indicated by the double arrow Z.

The long and fine elements 36 which are cut from the pieces 2 come into a hopper 37 (Figure 1) after having been in an inclined rotary drum 38 towards which they are guided by a hopper 39. In the inclined rotary drum 38, the long and fine elements 36 become arranged parallel to themselves before passing into the hopper 37. The elements 36 are carried out of the hopper 37 by a pair of rollers 40 similar to rolling mill cylinders. These cylinders have for effect to compress laterally the mass of long and fine elements coming out of the hopper 37 in such manner as to form a continuous bundle. These cylinders are at such a separation as to give rise at their outlet to a bundle 41 of small cross-section. The compression of this bundle may be increased by passing it into a fresh pair of cylinders 42, the axes of which are for example directed perpendicularly to the axes of the cylinders 40. If necessary the bundle coming from the second pair of cylinders can pass into one or more other pairs. There is thus obtained a continuous bundle which may be utilised for example as welding rod either for arc welding or for blowpipe welding or soldering. This bundle may be wound on a drum 53 or it may be cut into sections by means of a cutting machine shown diagrammatically at 44.

Where it is desired to distribute in a particularly precise manner over the length of the continuous bundle a body of a well defined composition the proportion of which in the bundle is to be small, there can be arranged in the interior of this bundle a continuous wire of such body 45 carried along at the same time as the elements 36, by the rolling mill cylinders.

Where it is desired to incorporate in the bundle substances in powder form intended to modify the composition of the final product, it is advantageous to add these substances to the elements 36 before the latter pass into the inclined rotary drum 38. This is shown on Figure 1 where substances in powder form are seen falling from a reservoir 46 into the hopper 39 receiving at the same time the elements 36 cut from the pieces 2.

It will be noted that the passage of the elements 36 from the point where they are cut up, to the hopper which feeds the rolling mill cylinders, and which takes place simply by gravity presents an important advantage as compared with heaping the elements at the foot of the cutting machine and having to pick these up to be loaded into the hopper 37. In fact, in the latter case, the compactness of the elements 36 loaded into the hopper 37 might easily vary which would unfavourably influence the regularity of the product coming from the rolling mill cylinders.

The bundle coming from the rolling mill cylinders does not have a mechanical strength which is comparable to that of a section iron obtained by casting and the rolling of a metallic mass, but a similar strength can easily be given to it by heating it at the outlet of the rolling mill rollers, up to a temperature permitting the welding together between themselves of the metallic elements by compression.

In Figure 6 there is shown an installation in which the bundle 41 coming from the rolling mill rollers passes first into a furnace 47 where it is heated to the temperature of welding of the metallic elements which constitute it, and then between the rolling mill cylinders 48 and 49 which effect the compression necessary for this welding. The product 50 coming from the rolls 49 may be cold drawn in a wire-drawing machine 51 in order to give a wire 52 having all the qualities of a wire obtained by the ordinary processes of manufacture. This wire may be wound on a drum 53 or be cut up by a cutting machine 44.

In Figure 7 there is shown an installation similar to that of Figure 6 in which the heating of the bundle 41 coming from the cylinders 42, instead of taking place in a furnace is effected by the passage of an electric current delivered by small wheels 54 arranged on each side thereof.

If necessary the rolling mill cylinders such as 48 and 49 could serve to deliver the heating current thus replacing the small wheels 54.

If it is desired to obtain a section product constituted by an alloy of definite composition pieces 2 of different composition and in accordance with the alloy to be formed are cut up by the cutting machines. The speeds of feed of these pieces are regulated, for example by the choice of the pulleys 17 and 19 over which pass the belts 18, corresponding to the proportion of the different metals which constitute the alloy to be formed. In the same way metallic pow-

ders necessary for the formation of the alloy are caused to drop from the reservoir 46. The bundle 41 of small cross-section coming from the rolling mill cylinders 42 is then used as the electrode in an electric furnace. This is what is shown by Figure 8 where it will be seen that the current is supplied to the electrode 55 of an electric furnace 56 by small wheels 57 connected to the secondary of a transformer 58, the other end of the winding being connected to the base of the furnace.

The slag is evacuated in a continuous manner from this furnace by means of an orifice 59 whilst the molten metal is continuously discharged through an orifice 60 in proportion to the fusion of the electrode.

Immediately after its exit from the furnace, this metal is cooled to a pasty state, passing through a nozzle 61 through the jacket of which passes water introduced at 62 and discharged at 63. The pasty rod coming from this nozzle is rolled to the desired profile by rolls such as 64, 65, 66, 67 and 68. There is thus obtained a wire 69 which may be drawn through a wire-drawing die 51 and either wound on a drum 53 or cut into pieces by a shearing or cutting machine 44.

The alloy thus obtained is of great regularity.

Actually, all the operations carried out in the manufacture of this alloy permit of obtaining great precision in the proportioning of the constituents, which is difficult to obtain with present-day industrial processes.

The possibility of instantly varying the proportion of each of the constituents permits not only of varying instantly and as desired, the characteristics of the alloy obtained but also of changing over in a very short time from the manufacture of one alloy to that of a very different alloy.

Instead of utilising cutting machines provided with a reciprocating movement, naturally other machines may be used.

If, for example, the output of long and fine elements is to be considerable, it may be of advantage to use machines comprising rotary tools. These tools may be arranged in such manner that several of them simultaneously cut into the same large piece.

In Figure 9, there is shown a metal piece formed by a cylinder 2 rotating in the direction of the arrow U in front of a tool 70 which may be displaced in the direction of the arrow W. This tool cuts out from the mass of the metal cylinder 2 a blank 71 having a cross-section substantially equal in area to that of a metal wire which it is desired to manufacture. The form of this cross-section, moreover, approximates to that of the wire to be manufactured.

The blank obtained in this manner is generally unsuitable for industrial use because the metal of which it is formed is cold worked and consequently "short." The blank may have fissures or incipient cracks. Moreover it is not always of the exact form and dimensions required.

In order to increase the mechanical resistance of the blank, it is hot rolled between a pair of rolls 48. The heating of the blank is carried out electrically by the *Joule* effect. For this purpose, a source of current of regulable intensity is connected to two terminals 72 and 73 connected respectively to brushes 74 and 75. The brush 74 bears against the metal cylinder 75, while the brush 75 bears against one of the rolls 48.

The blank 71 acts as a resistant element over its entire length between the metal cylinder 2 and the rolls 48. Consequently, the temperature of this blank increases in proportion as the blank approaches the rolls 5. Owing to the fact that the blank is heated until the moment it is rolled, it does not cool between the point at which it reaches its maximum temperature and the point at which it is rolled. Consequently, the maximum temperature to which the blank must be brought is that required for the rolling.

The hot rolling has the effect of restoring the metal by a form of forging to the sound condition which had been destroyed by cold working during the cutting. At the same time, the hot rolling has the effect of producing a shaped product having the exact section and form desired.

In order that the heat generated in the blank during the cutting thereof may be utilised, it is advantageous to dispose the rolls in the neighbourhood of the point at which the cutting of the blank is effected.

Between the point of the cutting and the point of the rolling, the blank 71 is passed into a sleeve 76 preferably constructed of heat-insulating material. In this manner, the cooling of the blank during its movement towards the rolls is reduced. This cooling is also counteracted by the circulation of a current of hot neutral gas, such as nitrogen, between the sleeve 76 and the blank 71. The nitrogen is introduced at 77 at the extremity of a sleeve 78 disposed behind the rolls 48.

By regulating the intensity of the current of nitrogen, the rate of cooling of the shaped product 79 leaving the rolls 48 may be varied. The nitrogen heated in this manner passes about the rolls 48 and then into the sleeve 76, leaving at the extremity 80 thereof, which is in the neighbourhood of the cutting point.

The use of a neutral gas such as nitrogen under the aforesaid conditions also has the advantageous effect of preventing oxidation of the metal while it is at a sufficient temperature to oxidise rapidly in the presence of air.

Upon leaving the rolls 48, the shaped product 79 has, for example, the form of a wire of circular cross-section. A wire of this type may be advantageously used as a welding bar and in particular as an electrode for arc welding. If it is desired further to improve the mechanical properties of this wire, it may be drawn after sufficient cooling by passing it through a draw plate 51. The drawn wire 52 leaving this draw plate may be wound on to a drum 53 driven in the direction of the arrow P.

If it is not desired to obtain a shaped product having mechanical properties such as those obtained after hot rolling, the blank 71 may merely be cold rolled. In this way, a shaped product having good mechanical properties is obtained, particularly if the blank is very thin.

Annealing of the shaped product substantially improves the mechanical properties of the shaped product obtained by cold rolling.

Use may also be made of a ribbon of this nature for forming, either alone or in juxtaposition with other similar ribbons, the tubular covering of a welding bar and in particular of an electrode for arc welding formed in manner known per se as a tubular covering obtained by winding one or more strips and containing other materials, generally in pulverulent form.

If it is desired to manufacture a shaped product of relatively great thickness, for example a hoop iron, it may be difficult to cut a blank of sufficient thickness to form by itself the shaped product in question. This difficulty may be due

especially to the fact that the cut metal would be too cold-worked and that the tool would be abnormally worn. In this case, several blanks of a total thickness corresponding to that of the desired shaped product may be welded by hot rolling.

Figure 10 shows a metal piece 2, from which two blanks, such as 71 and 71′ are simultaneously cut by means of tools designated respectively by 70 and 70′, and a metal piece 2′ from which a blank 71″ is cut by means of a tool 70″. These three blanks 71, 71′ and 71″ are applied one against the other by means of a pair of rolls 81 electrically connected to the current terminal 72 by brushes 82. The other current terminal 73 is connected by brushes 83 to rolls 49. The heating of the three blanks applied one against the other is produced by the Joule effect between the rolls 81 and 49. This heating is such that the temperature of the blanks is sufficient to permit welding thereof owing to their passage between the rolls 49. This temperature may therefore be somewhat higher than in the case of the process illustrated in Figure 9, in which the rolls 48 serve solely to impart the desired form and section to the shaped product 79.

In the case of the installation shown in Figure 10, the shaped product 79 leaving the rolls 49 passes afterwards between finishing rolls 48, which serve the same purpose as the rolls 48 in Figure 9.

The metal cylinder 2′ is assumed to be of different composition from the metal cylinder 2. The shaped product 79 obtained by the combination of the blanks 71, 71′ and 71″ is therefore a heterogeneous shaped product of the type generally known as "bi-metallic."

Figure 11 shows an installation in which a tool 70‴ cuts from a piece 2″ blanks such as 71‴ of definite length. Two of these blanks have been superimposed one upon the other so that their extremities coincide before they pass between the rolls 49. The heating of the blanks before the passage thereof between the rolls 49 is effected by means of gas burners 84, so that these blanks are welded together during the course of their hot rolling. Upon leaving the rolls 49, the shaped products may be tempered by sudden cooling in a bath of oil or water 85.

This method of carrying out the process is admirably suitable for producing hoops. The rolls 49 may be followed by other rolls, such as the rolls 48 shown in the previous figures.

It will be understood that the invention permits of producing not only wires, strips and sheets, but also other shaped products, especially shaped products of small section.

It will also be understood that the heating could be effected under conditions other than those described in the foregoing.

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PUBLISHED

APRIL 27, 1943.

BY A. P. C.

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PROCESS AND INSTALLATION FOR THE MANUFACTURE OF SHAPED METAL PRODUCTS

Filed June 12, 1939

Serial No. 278,768

7 Sheets-Sheet 1

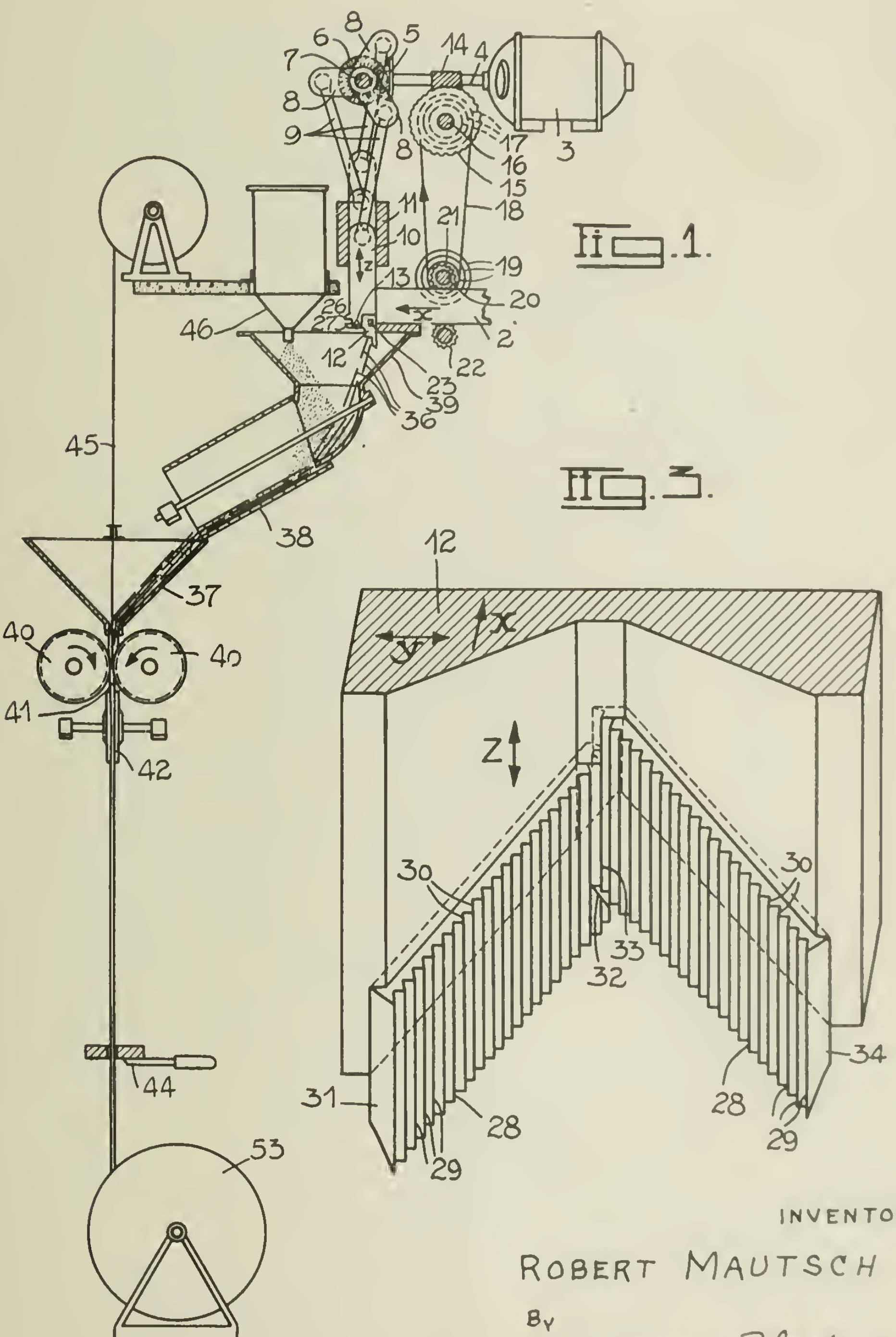

Fig.1.

Fig.3.

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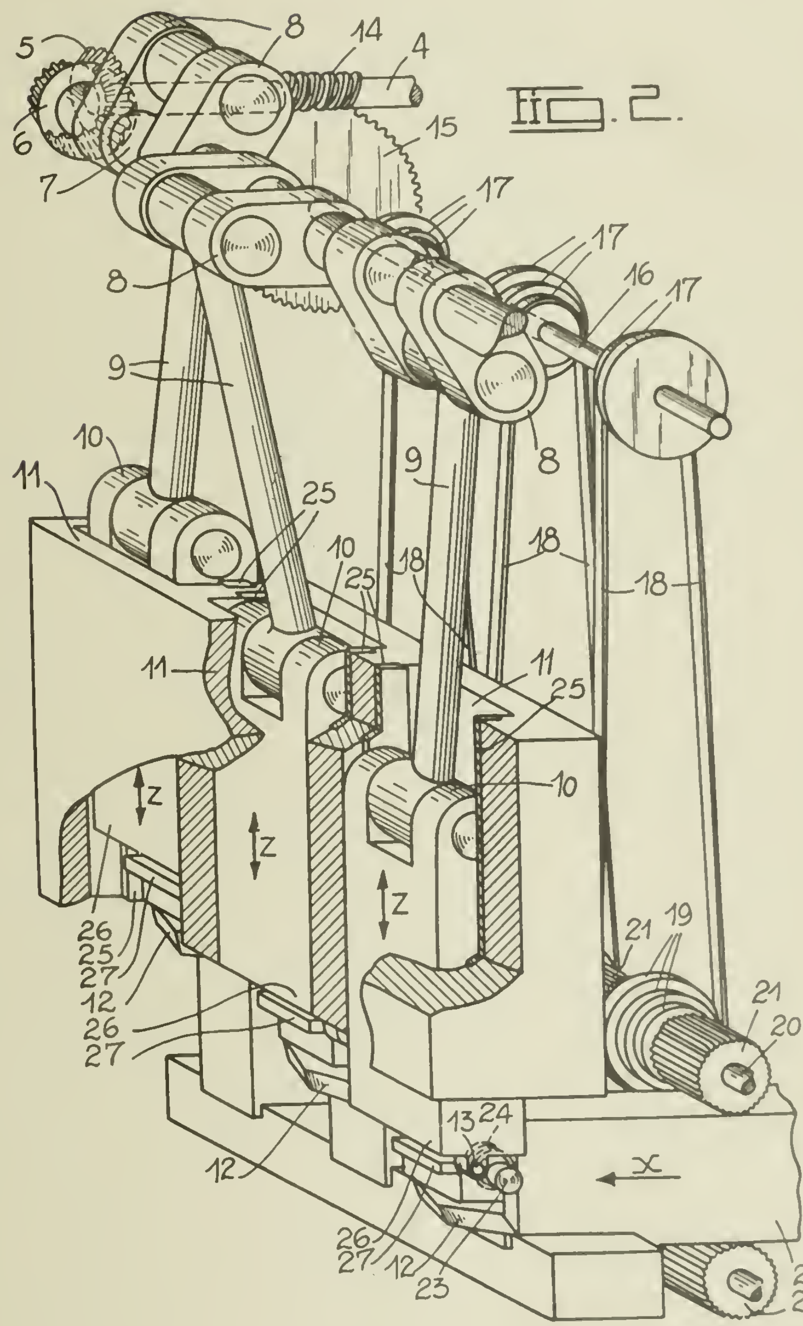
PROCESS AND INSTALLATION FOR THE MANUFACTURE OF SHAPED METAL PRODUCTS

Filed June 12, 1939

Serial No. 278,768

7 Sheets-Sheet 2

Fig. 2.



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Filed June 12, 1939

Serial No. 278,768

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Fig. 4.

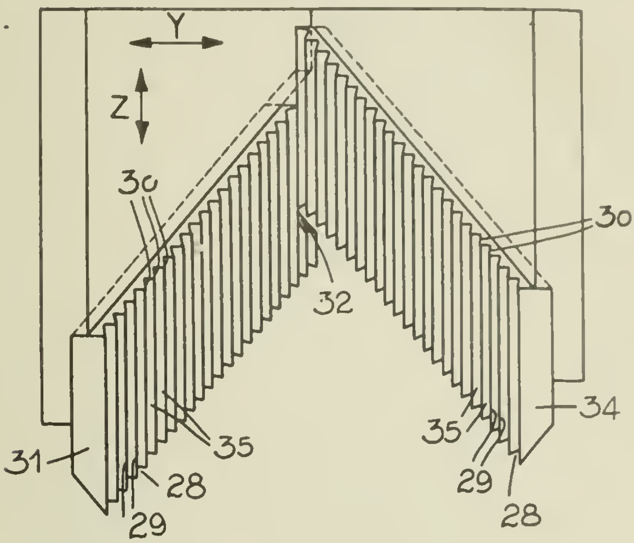
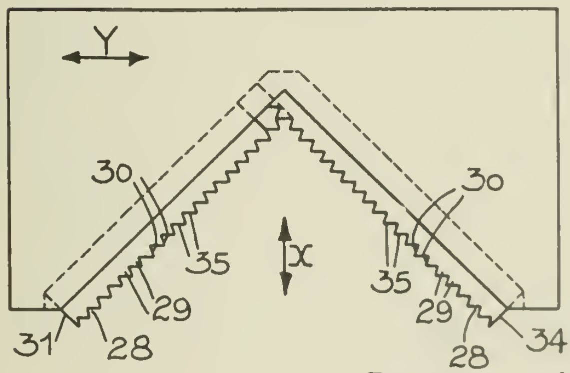


Fig. 5.



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Filed June 12, 1939

Serial No. 278,768

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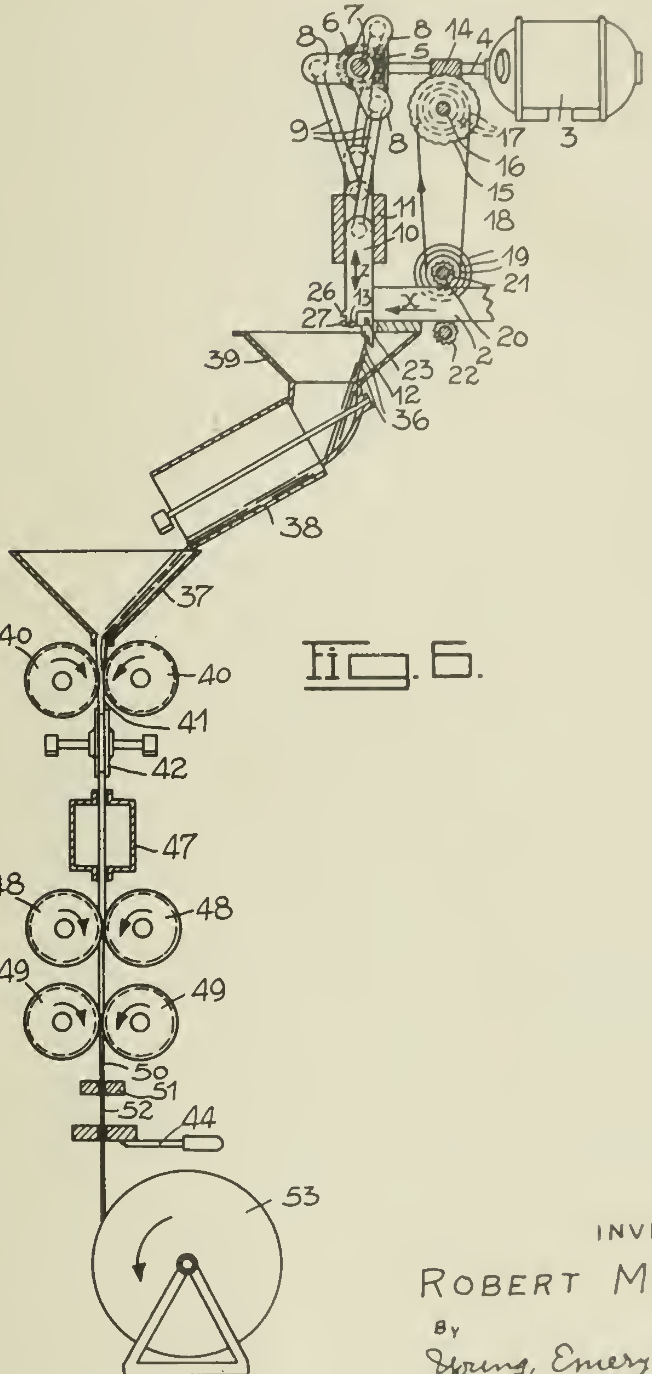

Fig. 6.

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OF SHAPED METAL PRODUCTS
Filed June 12, 1939

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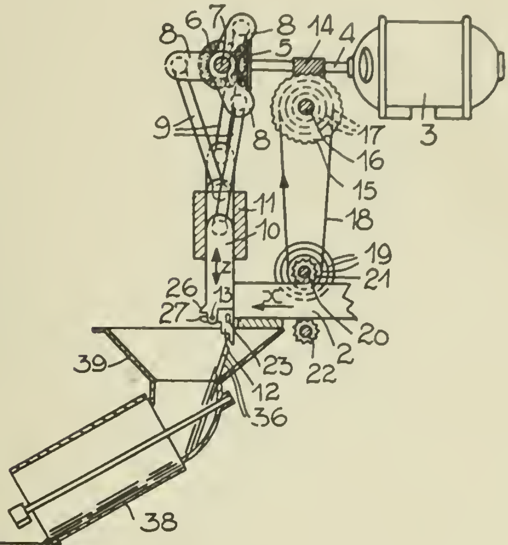

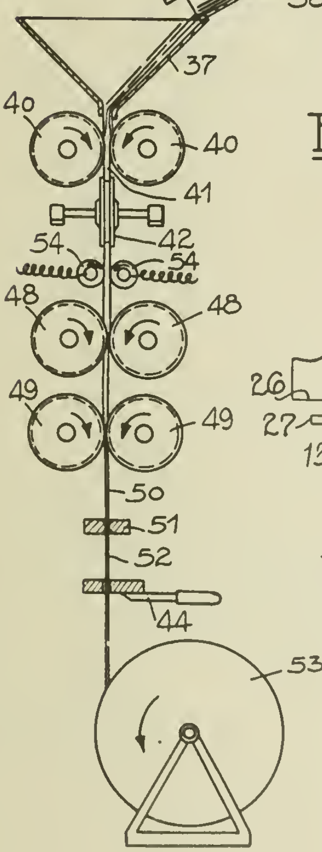

Fig. 7.

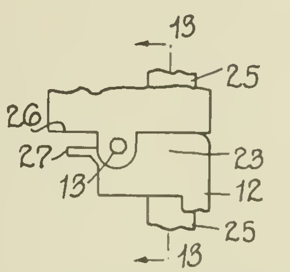

Fig. 12.

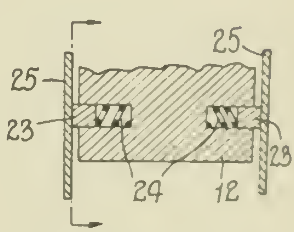

Fig. 13.

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Filed June 12, 1939

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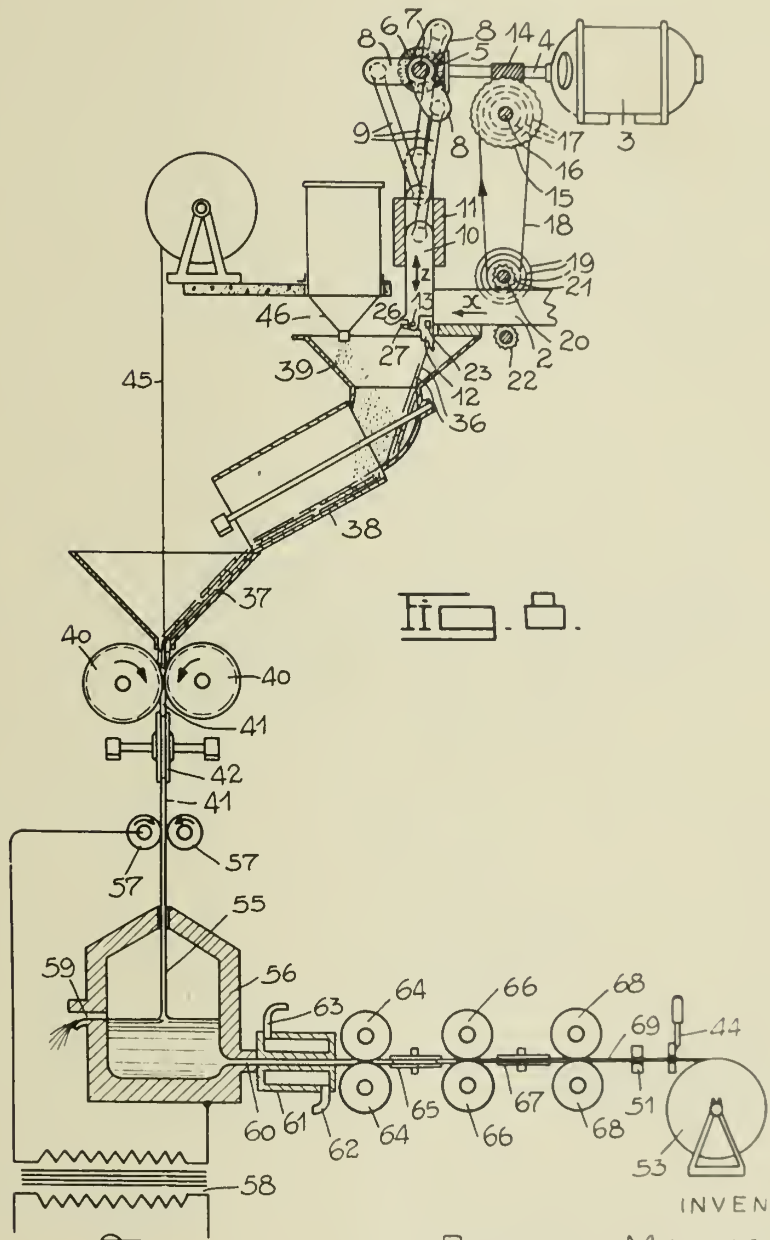

Fig. 8.

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APRIL 27, 1943.
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OF SHAPED METAL PRODUCTS
Filed June 12, 1939

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Fig. 9.

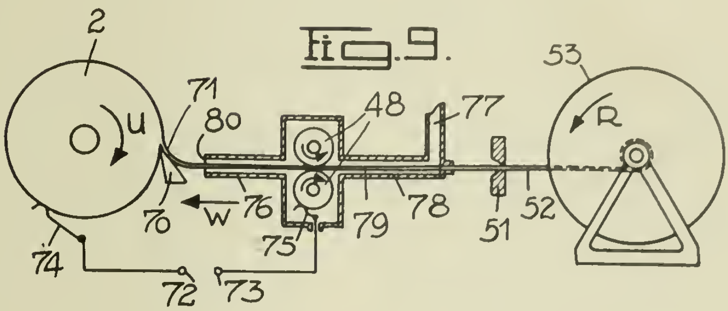


Fig. 10.

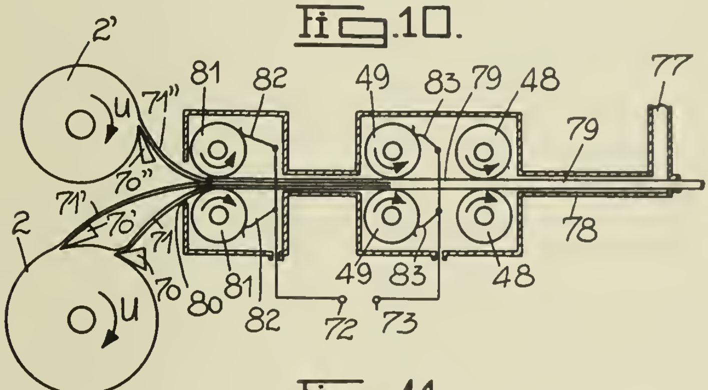
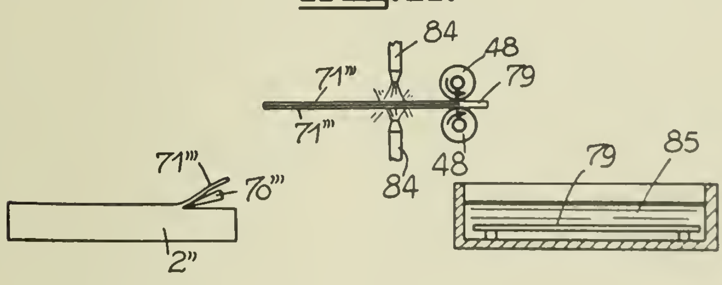


Fig. 11.



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Published Apr. 27, 1943

Serial No. 280,012

ALIEN PROPERTY CUSTODIAN

POWER PLANT, IN PARTICULAR FOR THE MECHANICAL PROPULSION OF IMMERSED MACHINES, AND MACHINES EMBODYING SAID POWER PLANT

Henri Tailleferre, Paris, France; vested in the Alien Property Custodian

Application filed June 19, 1939

This invention has for its object a power plant which is intended in particular for propelling immersed machines such as submarines, torpedoes and submarine mines for example, in such a manner that nothing can reveal their presence.

Said plant is mainly characterized by the fact that, for actuating the engine or engines which drive the propeller or propellers of the immersed machine, a liquefied or optionally a solidified gas is used, which is automatically raised to its utilisation temperature by one or a plurality of exorthermic chemical reactions in which participates the liquid wherein the machine evolves, the gas which is utilized and also the agents which react together being furthermore such that the gaseous exhaust products of the engine or engines and likewise the products to be educed from the reaction or reactions are soluble in the liquid wherein the machine thus powered evolves.

As a result of the use of these liquefied gases and of the phenomena which ensue therefrom, the reserve of power that is stored up is considerably increased.

Thus, by way of example, an ordinary torpedo which has a reserve of 400 litres of air at 200 kg. per sq. cm. raised to the utilization temperature, viz. 500° C., has available about 224 cub. metres of gas brought down to atmospheric pressure, whereas the same machine equipped with the novel devices would have available a reserve of about 1.120 cub. metres. Furthermore, the storage vessels, instead of being subjected to a pressure of 200 kg. per sq. cm. would only be subjected to a pressure of about 30 kg. per sq. cm. This is a great advantage, since the saving of weight effected on the storage vessels can be used, either to increase the reserve of power, which also corresponds to an increase of range, or to increase the weight of the explosive charge.

It follows from the above figures that, under the present conditions, the range is multiplied by five, that is to say that for a normal torpedo of 550 mm. diameter, which has a range of about twelve kilometres, the range will be about sixty kilometres when said torpedo is equipped according to the invention.

Several embodiments of power plant according to the invention, and also of powered machines involving the application of same, are described hereinafter and diagrammatically illustrated in the accompanying drawings in which:

Fig. 1 shows a power plant in one of the simplest embodiments; and

Fig. 2 shows a more complex embodiment;

Fig. 3 is an overall view of an individual submarine of semi-directed torpedo, equipped with a power plant according to the invention;

Fig. 4 shows the evolutions of the individual submarine for battle;

Fig. 5 is a fragmentary view, in longitudinal axial section, showing a mounting detail of the war head of the individual submarine;

Fig. 6 is a transverse section of Fig. 5; and

Fig. 7 shows a detail of Fig. 5.

Fig. 8 is an elevational view of a mine which is made self-propelling by the application of a plant according to the invention, said mine being furthermore provided with a rotary fin device which is shown in its folded position in the manner in which it is arranged during the first phase of the fall of the machine;

Fig. 9 shows the machine with the fins developed, such as they are positioned for effecting the braking during the second phase of the fall;

Fig. 10 shows the mine after immersion;

Fig. 11 shows diagrammatically the successive modifications of the mine during the fall and after immersion;

Fig. 12 is a detail view in diametrical vertical section of the device for automatically starting the engine of the mine after immersion; and

Fig. 13 is a view in diametrical vertical section of the delayed release mechanism which, at the required instant, causes the fins to unfold for braking the fall.

Referring to the power plant shown in Fig. 1, A is a reservoir containing, for example, liquefied ammonia gas and provided with a heating coil B; F is a dome located at the upper part of the reservoir A for the take-off of the gaseous ammonia; M is an engine on the shaft of which is fixed the propeller N of the powered machine; O is a tank, hereinafter called absorber-heater.

The plant operates as follows:

The ammonia gas flows from the dome F to the inlet Q of the engine M and so actuates said engine, the exhaust gases of which flow from the exhaust pipe R into the absorber-heater O. Into this tank is introduced, through a pipe S which is controlled by a float valve T, the liquid in which the machine evolves, for example, sea-water. The solution of the ammonia gas in the water evolves heat and the hot ammoniacal water is driven, by a pump V actuated by the engine M, into the coil B and heats the liquid ammonia in the reservoir A; the ammoniacal water is then exhausted through the pipe into the sea.

By means of this self-heating, the utilization temperature is very quickly reached.

Of course, instead of the float device T, a pump could be used, likewise actuated by the engine M.

In this operation, the sole elements involved are therefore, on the one hand the gas used for actuating the engine, and on the other hand the liquid, for example the sea-water, in which the machine equipped with the plant in question evolves.

In the embodiment of Fig. 2, in addition to the liquefied gas and the ambient liquid, another reacting agent is involved, in this case and for example, concentrated sulphuric anhydride or oleum.

In this figure, A is the reservoir containing liquefied ammonia gas and provided with heating coils B and C; D is a tube arranged in the reservoir in such a manner as to enable the liquid ammonia to be taken up by a pipe E dipping into the tube D. F is the dome which is located at the upper part of the reservoir A and serves for the take-off of the gaseous ammonia.

G is a reservoir of sulphuric anhydride (oleum), the upper part H of which forms an air chamber; I is an auxiliary piston engine, J^1, J^2, J^3 are three piston pumps actuated by the auxiliary engine I; K is a mixer connected to the pumps J^1, J^2; L is a superheater, M is the main engine, on the shaft of which is fixed the propeller N of the powered machine, O is the absorber-heater.

The operation is as follows:

The ammonia gas taken off at the dome F is conveyed to the auxiliary engine I which is set in motion and in turn actuates the three pumps J^1, J^2, J^3. The pump J^1 sucks sulphuric anhydride taken from the reservoir G and drives it into the mixer K into which, on the other hand, the pump J^2 delivers water obtained from the absorber-heater reservoir O.

The two liquids intermingle and produce an exothermic reaction, thereby enabling the liquid ammonia drawn into the tube E by the pump J^3 to be superheated in the boiler L. The ammonia issuing from the superheater L flows into a nozzle P of the Venturi type connected to the exhaust of the auxiliary engine I which causes a depression in the exhaust of the engine. The ammonia flows thence to the inlet Q of the main engine M which it actuates. The exhaust R of the engine M exhausts its gases into the absorber-heater O which is provided with a water inlet S controlled by a float valve T and with an outlet U for the heated ammoniacal water provided with a pump V. The ammonia dissolves in the water in the tank O and evolves heat; the hot ammoniacal awter is pumped by the pump J^2 so that in the mixer K it is converted into a solution of ammonium sulphate by exorthermic reaction with the oleum.

In order not to modify the ballistic coefficient of the machine, a quantity of liquid is introduced at the base of the reservoir A, equal in volume to that of the liquid ammonia used.

A portion of the ammoniacal water issuing from the absorber-heater O is used as substitution water at the lower part of the reservoir A wherein it is introduced through the tube W. The ammoniacal substitution water is separated from the ammonia in the reservoir A by an oil piston X or by any other means.

The excess of hot ammoniacal water is used, by passing it through the coil B, for heating the liquid ammonia stored in the reservoir A; said excess is then exhausted into the ambient medium.

Furthermore, after being used in the superheater L, the hot solution of ammonium sulphate is also used for heating the ammonia in the same tank A by circulating said solution in a coil C whence it is exhausted into the ambient medium.

As regards the machine shown in Figs. 3 to 7, said machine forms an individual submarine, the front head of which forms one or a plurality of compartments intended for introducing either torpedoes of reduced size owing to the short travel they will have to effect by their own means, or a single removable war head. Said machine is adapted to be guided by a pilot or by remote control and can travel at very high speed; at the most suitable firing distance, that is to say at the position shown at *a* in Fig. 4, its war head or the torpedoes is fired and finishes alone the last part of the travel to the target *b* while the body proper of the submarine turns right around and returns to its base (surface vessel or launch, hydroplane *c*, or fixed station), the whole of these journeys being effected entirely under water and without any trace at the surface. The dotted line *d* represents the return journey.

The novel machine ensures:

(*a*) an infinitely greater probability of hitting the target than do the present known torpedoes, both owing to its speed and to its guiding and its invisibility;

(*b*) a substantial economy with respect to the ordinary torpedo which is completely destroyed or lost, whereas in the present case, only the war head or the small torpedoes contained in the compartments are sacrificed for obtaining an infinitely more certain result, while the individual submarine can be re-equipped and used again.

In Fig. 3, the rectangle **1** diagrammatically represents the power plant which may for example be of the type shown in Fig. 2 and which actuates the propeller N. A is the ammonia reservoir and G the sulphuric anhydride reservoir.

In this figure, the machine is assumed to be guided by a pilot **2** who is located in a compartment adapted for this purpose and to which access can be had through a water-tight door **3**. The man is placed parallel with the longitudinal axis of the machine; a sliding base **4** on which he lies is provided with a dash-pot device **5** which is intended to absorb the negative or positive accelerations. Two elbow-rests **6**, which are connected by an appropriate device to the vertical rudder **7**, enable the horizontal trajectory of the machine to be modified; opposite each elbow-rest is provided a handle **8** which is also provided with a dash-pot device **9** and on which is arranged a release **10**. One of the releases, the left hand one for example, enables the pilot **2** to release the machine from its catch elements in the case in which it is carried, for example, by an aeroplane. The other release, that is to say the right hand one, is adapted in this case to cause the war head **11** or the torpedoes to be fired.

A periscope **12**, which can be folded down and is mounted with a knuckle-joint at **13**, enables the pilot to guide the machine towards the target. Said periscope has as an optical system a set of prisms **14** which are connected together by a system of connecting rods forming a hinged parallelogram **15** in such a manner that the prisms pivot in harmony when the periscope is raised or is folded down; it is furthermore provided with a mirror **16**. When inoperative, that is to say before immersion, the periscope is folded down horizontally as shown; as soon as the machine is immersed, the knuckle-joint **13** is released by a hydrostat **17** of known type which automatically

unlocks the knuckle-joint, so that the periscope swings into the upright position.

Of course, the air necessary for the pilot to breathe is contained in a reservoir and may optionally be activated by the combustion of oxylith.

With regard to the war head 11 carrying the explosive material, said war head, which is located at the front of the machine, is simply fitted with a sliding fit in a firing tube 18. The end 11' of the war head is separated from the end 18' of the firing tube by a dummy end 28 of similar shape, which is mounted with a sliding fit in the tube 18.

Two rocket-tubes 19 secured to the war head 11 are fitted with a running fit in two tubes 26, like pistons in their cylinders, wherein 19 are the pistons and 26 the cylinders, said rocket-tubes 19—26 being arranged diametrically opposite and parallel with the generatrices of the machine, the projections 19' which connect the rocket-tubes 19 to the war head 11 passing through slots 20 forming slideways provided in the launching tube 18.

The end space left between each rocket-tube 19 and its tube 26 is supplied with a cartridge of powder, the firing of which is controlled by the pilot of the machine, or again by a take-off of compressed gas obtained from the pipe leading from the superheater to the main engine M.

According to the position of the centre of gravity of the projectile unit, that is to say of the war head 11 and of the rockets 19, two carrier planes 21 are arranged, the function of which is to sustain the war head 11 as soon as same has left the machine. In view of the fact that said war head has to be able to propel itself below a constant plane of water, the sustaining fins 21 are pivoted about a pin 22 so as to modify the value of the angle of incidence proportionally to the hydrostatic pressure and to a gyroscope acting simultaneously as a servo-motor on the system.

In order to obtain this operation, a part of the pressure of the liquid may be used which is taken up by means of a tube 23 fixed along the tube 18, and also the phenomenon of cavitation produced at the rear of the moving body by its own displacement.

The hydrostat 24 and the gyroscope, which are of known design and are used in existing torpedoes, therefore act as a servo-motor on a differential device 25, using the two above mentioned phenomena; said differential device is mechanically connected to the pivot pin of the sustaining fins 21.

The operation is as follows:

This machine, which is assimilable to a semi-guided torpedo, can be hooked under the fuselage of an aeroplane, for example, the hooking device being released by the pilot of the machine.

A fork system bearing on the vertical rudder of the machine, makes it possible, by means of a system of rods, to inform the pilot of the aeroplane of the exact course he should follow. As soon as the target is projected on to the telemetric mirror 16 of the periscope 12 of the pilot of the machine, the latter acts on the release of the left handle and thereby releases the machine from its hooking device.

On contact with the water and by means of a known device, the machine starts its propelling apparatus and at the same time the hydrostat 17 which locks the periscope 12 in the folded down position releases said periscope.

From this instant onwards, the machine thus piloted follows a navigational course in the direction of the target, which direction can be corrected according to the evolutions of said target, by means of the elbow-rests 6 which are available to the pilot and are connected to the controls of the machine in the manner of the so-called "scissors" device which is used in aeroplanes for controlling the ailerons. A depth correction is also provided by simultaneously operating the elbow-rests in the same direction, for the accidental case in which the gyroscope ensuring the depthwise stability of the machine might fail.

As soon as the target projected on to the telemetric mirror 16 appears in the circle of aim, the pilot fires the war head 11 by actuating his right handle 8; the rocket-tubes 19 secured to the head are driven out of the tubes 26 which are arranged on the machine proper. This driving is effected either by means of powder, or as stated above by means of ammonia gas; this sudden expansion causes the percussion of a lighting fuse by means of inertia masses each arranged inside the rockets which become operative after a predetermined time, thereby ensuring the propulsion of the war head 11 towards the target. Stability is ensured during the travel, in the horizontal direction by means of two small compensated rudders fixed on the two rocket-tubes 19 and controlled by a gyroscope, and in the vertical direction by means of the hydrostat 24 acting through the intermediary of the hydrostatic relay on the sustaining fins 21 (variation of incidence).

When the war head 11 is fired, a depression occurs at the rear of its end 11' which causes the dummy end 28 to move forwards by sliding inside the tube 18 and take up the position originally occupied by the front part of the war head. The dummy end locks itself in this forward position by the engagement, in openings 27 (Fig. 5) provided in the tube 18, of fingers 29 (Fig. 7) which are urged by leaf springs 30 arranged inside the dummy end 28. Furthermore, the water penetrates into the tube 18 through the slots 20. In this manner the ballistic coefficient of the machine is not modified for the return journey after the war head has been fired.

Figs. 8 to 13 show the application of the invention to a submarine mine, thereby enabling a movement to be automatically imparted to the latter when it is immersed, so that it may be made to follow either a straight or a spiral course whereby the zone which is effectively swept forms a very vulnerable field for vessels which might be located in that zone.

The power plant, of the type for example of the one shown in Fig. 1, is lodged at the base of the mine 31; in Fig. 8 the reference letters A B M N O V designate the same members as in Fig. 1; T' designates a pump which, like the pump V, is driven by the engine M and ensures the supply of sea-water to the absorber-heater O; 32 designates an immersion control device of a type known per se which enables the mine to evolve vertically like a ludion and 33 the usual antennae (Fig. 10) or any other known firing devices which cause the mine to be fired by a known device when the antenna is struck by a ship or other like object.

For obtaining the automatic starting of the engine when the mine is immersed, a device is provided which, under the action of the sea-water, opens the supply of ammonia gas to the engine M.

Such a device has been shown in Fig. 12. In

this figure, 35 is a needle valve controlling an orifice 36 through which the ammonia supplied by a pipe 37 can be introduced into the engine M; the head 38 of said needle valve rests, through the intermediary of a corrugated metal tube 39 welded to said head, on an inner flange of a bush 40 secured to the engine M; the upper part of the head 38 is recessed so as to serve as a housing for a block 41 of sea salt which is held by a clamping plug 42 screwed on the bush 40 and provided with holes 43 to enable the sea-water to act on the block 41. It will be readily understood that, when said block 41 is disintegrated by the sea-water, the needle valve 35 is lifted by the pressure of the ammonia gas and that of the corrugated tube 39 acting on the lower face of the head 38. Consequently, the ammonia is supplied to the engine M which starts operating.

With the advantage ensuing from the fact that it is self-propelled, this mine, which is intended to be thrown by aeroplane, combines those ensuing from the fact that, throughout its drop from the aeroplane until approaches quite near the plane of the water, it retains its ballistic characteristics which are comparable to those of a normal bomb, whereas as soon as it penetrates into the water, it becomes a real submarine mine owing to the fact that it is released from the device which braked it in the second phase of its fall.

Fig. 11 shows the different phases of said fall; *e* designating the aeroplane, at m^1, m^2, m^3 is shown the appearance of the mine during its free fall, at m^4 its appearance when the braking device with rotary fins *p* with which it is provided has spread out and its fall is braked; m^5 shows the appearance of the mine after immersion when it is released from the detachable fin device *p*.

The detachable fin device forming the braking device is shown folded in Fig. 8 which corresponds to the first phase of the fall, that is to say the free fall; it is shown spread out in Fig. 9 which corresponds to the second phase of the fall, that is to say, the braked phase. 34 designates blades.

The delay release device for opening the fins is shown in detail in Fig. 13.

In this Figure, 45 is an artillery fuse, called a disc fuse provided with a known striker device 46, said device containing a Bickford fuse 47, or the like, which transmits its flame to a charge of powder 48. The fuse 45 is screwed on a sleeve 49, on which are pivoted connecting rods 50, the number of which corresponds to that of the supports 51 of the blades 34.

Each support 51 is pivoted on a shaft 52 carrying a toothed quadrant 53, on the end 53′ of which the head of the connecting rod 50 abuts. The toothed quadrant 53 meshes with a rack 54 provided on the periphery of a bush 55 about which is concentrically arranged an outer sleeve 56. The assembly thus obtained, and which forms a rotatable head, is mounted on ball bearings 57—58, so that it can effect a rotary movement about its vertical axis. On the ball bearing 57 is mounted an abutment 59 forming a shoulder for a coil spring 60 which bears, on the other hand, against the part 61, which is secured to a brace tube 62 connecting the movable head to a base 63, loosely fitted in a bush 64 secured to the mine 31.

In the part 61 is provided a groove 65 which enables balls 66, partially engaged in a groove 67 provided in the main rod 68, to be held stationary.

Said rod 68 is connected by a connecting rod 69 to a locking hook 70, to which is hooked the mine 31.

71 are shocks absorbing spring devices, secured on a rotating ring 71′, for braking the opening movement of the supports 51 of the blades 34.

When the powder 48 explodes, the fuse 45 is projected, and thus carries with it the whole of the movable part, as well as the connecting rods 50, thereby enabling the arms 51 supporting the blades to open, and to rotate about the vertical axis of fall, in the manner of a helicopter, which brakes the speed of fall of the mine. The head 53′ then bears on the upper part of the sleeve 56, which thus forms an abutment. Owing to the rotary movement of the blades about the pivot 52, the quadrants 53 cause the bush 55 to move downwards, until the instant when the collar 59 abuts against the upper part of the central rod 68 and thereby causes said rod to move downwards. At this instant the balls 66, which are lodged in the groove 65, are released and fall.

As soon as the mine touches the water, and owing to the lightening which ensues therefrom, the blades, which are urged on the one hand by the spring devices 71, and on the other hand by the main spring 60, eliminate the thrust previously exerted on the rod 68 by the collar 59. As the latter is no longer retained by the balls 66, it continues its upward movement under the action of the spring 72, thereby pulling the connecting rod 69 and causing the retaining hook or catch 70 to pivot; the spring 73 which is lodged in the base 63 of the brace tube 62 therefore drives the whole arrangement, and thus completely releases the mine 31 from its sustaining members.

It is, of course, understood that the invention is in no way limited to particular embodiments, and that without exceeding the scope of the invention, numerous modifications and improvements of detail can be conceived, as well as the use of means forming equivalents of those given by way of example.

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PUBLISHED
APRIL 27, 1943.
BY A. P. C.

H. TAILLEFERRE
MARINE POWER PLANTS
Filed June 19, 1939

Serial No.
280,012
3 Sheets—Sheet 1

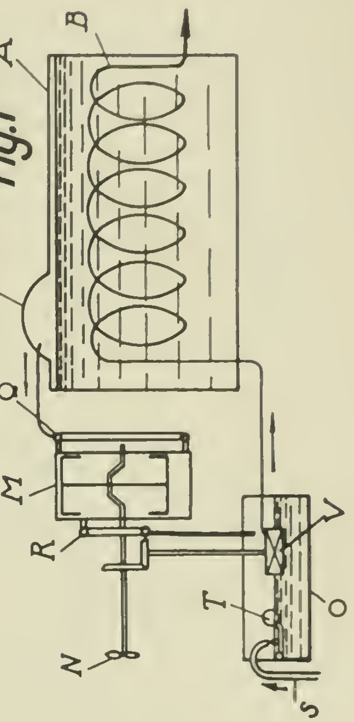

Fig. 1

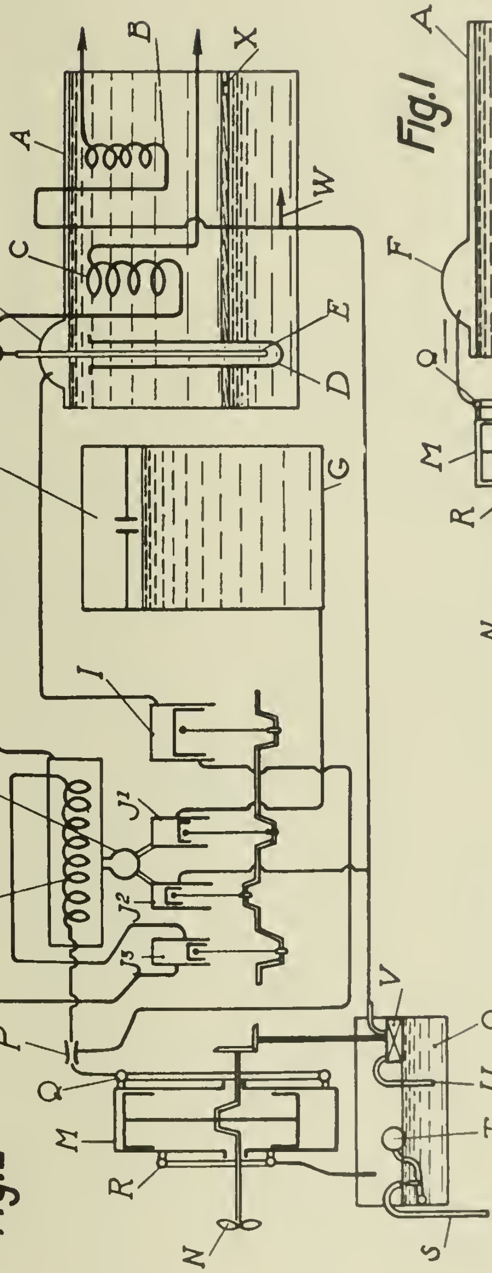

Fig. 2

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PUBLISHED

APRIL 27, 1943.

BY A. P. C.

H. TAILLEFERRE

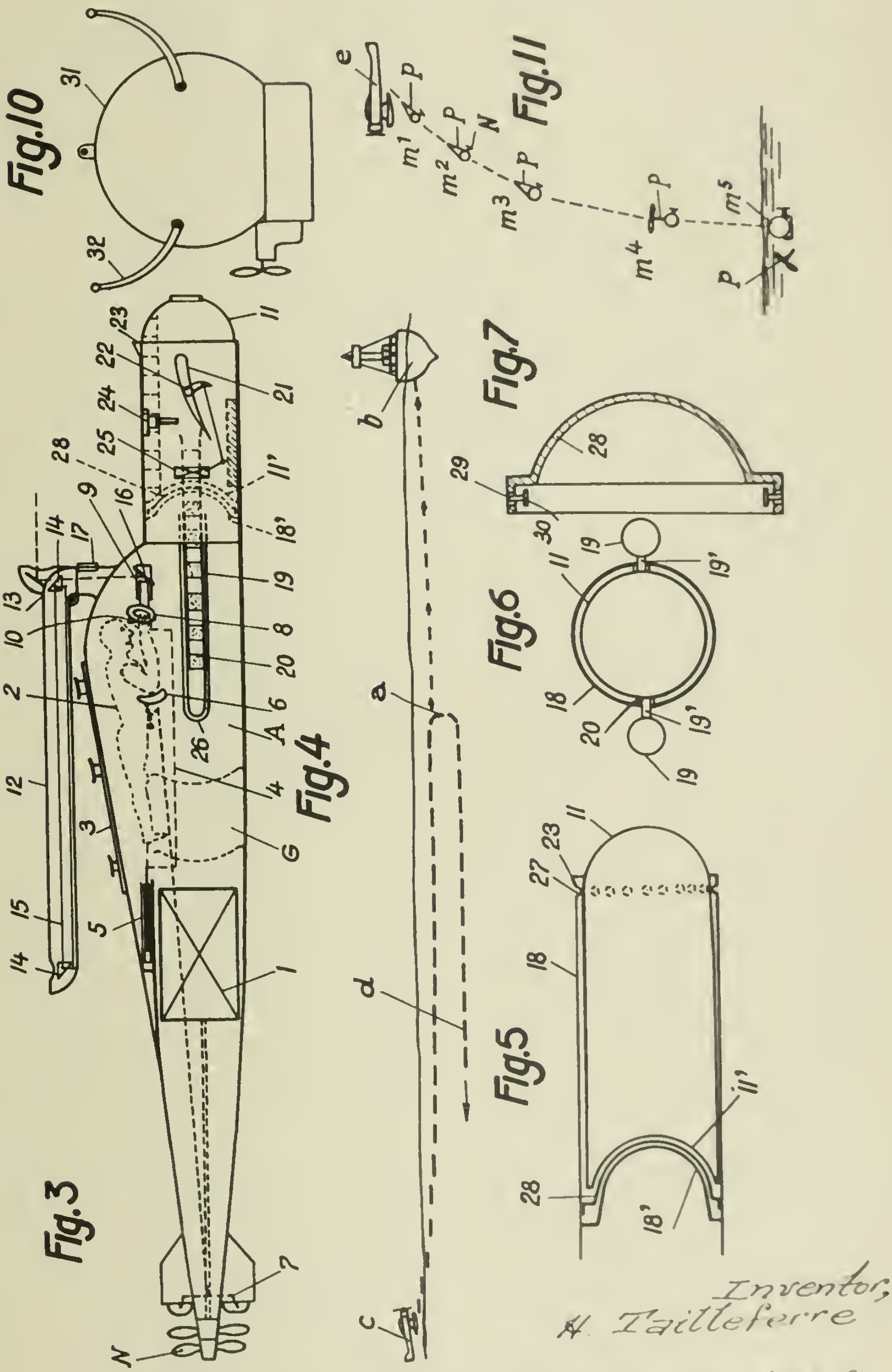
MARINE POWER PLANTS

Filed June 19, 1939

Serial No.

280,012

3 Sheets-Sheet 2



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PUBLISHED
APRIL 27, 1943.
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MARINE POWER PLANTS
Filed June 19, 1939

Serial No. 280,012
3 Sheets-Sheet 3

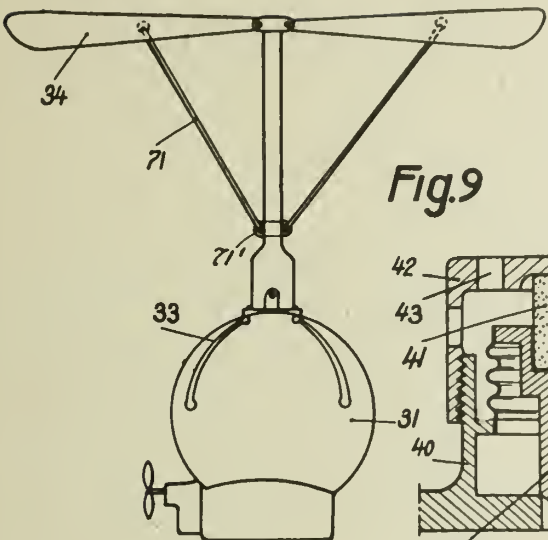


Fig.9

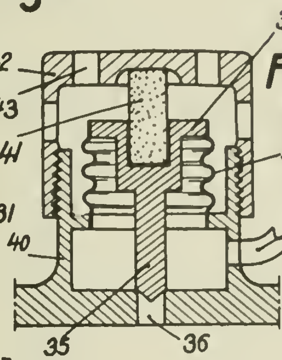


Fig.12

Fig.8

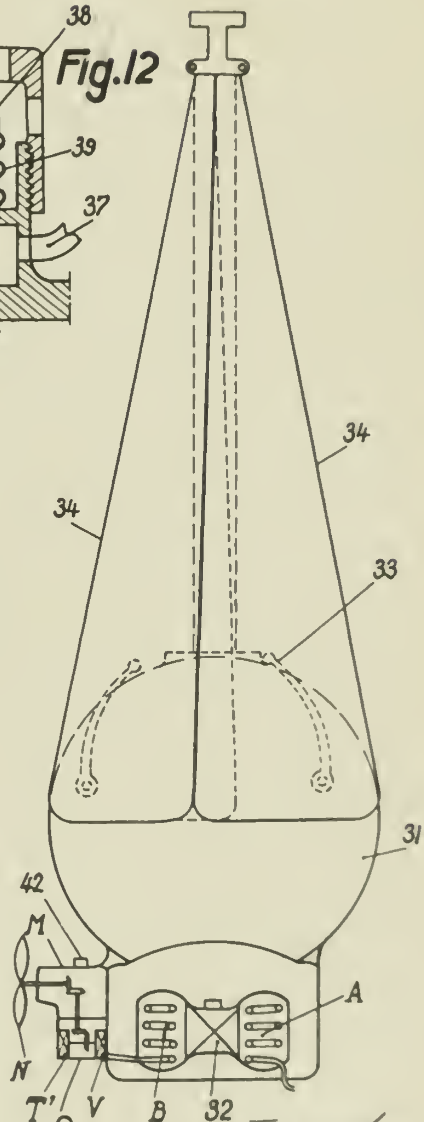
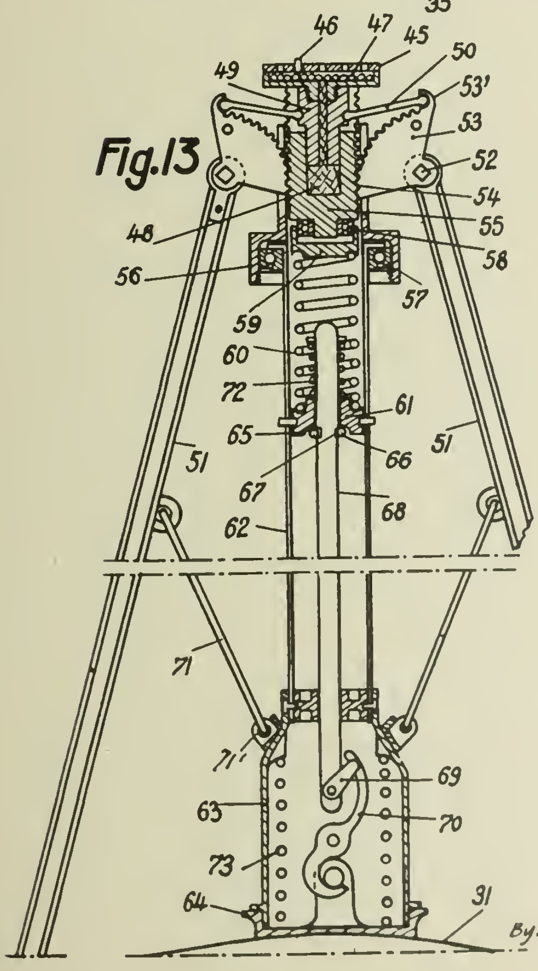


Fig.13



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Published Apr. 27, 1943

Serial No. 280,215

ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PRODUCTION OF CAUSTIC BURNED MAGNESIA

Josef Berlek, Radenthein, Germany; vested in the Alien Property Custodian

No Drawing. Application filed June 20, 1939

The caustic burned magnesia which is used particularly for the manufacture of Sorel cement and its varieties, is produced chiefly from amorphous (dense) magnesites, whereas the crystalline magnesites are generally only usable in the production of dead-burned magnesite; an exception are the occurrences in Oberdorf (Steiermark) and in the Zillertal (Tirol) where a crystalline magnesite relatively poor in iron occurs which can also be used in the manufacture of caustic burned magnesia. The problem of enabling the existing large deposits of crystalline magnesite rich in iron to be used in the preparation of caustic burned magnesia, has all along been the task of the magnesite experts. According to a proposal made some time ago, the production of caustic burned magnesia from such magnesites is rendered possible by carrying out the calcination of the magnesite slightly above the lowest temperature required for driving out the carbon dioxide, while introducing steam into the calcining zone, so as to prevent the outer parts already causticized of the material under treatment from being superheated, and as a consequence dead burned during the expulsion of the carbon dioxide from the interior of the lumps. This process has proved to be practical in the calcination of magnesite in rotary furnaces, but even in furnices of this kind it is not possible to obtain a product which is able to compete successfully with the caustic burned magnesia obtained from amorphous (especially Grecian) magnesia, because in keeping to the low temperatures which are necessary to attain the quality properties of the product resulting from amorphous magnesites, the throughput of the furnace drops to such an extent that the production becomes uneconomical.

In connection with the working up of crystalline magnesites occurring in large deposits, which are rich in iron in comparison with the amorphous magnesites, the present invention has for its object to conduct the calcining operation in such a manner that thereby is ensured the economical production of caustic-burned magnesia which is in no way inferior to the commercial products obtained from amorphous magnesites. This is attained according to the invention substantially by completely preventing the conversion of the ferrous oxide contained in the prime material into ferric oxide during the burning operation.

If the calcining of the magnesite is carried out with admission of air the ferrous oxide oxidizes to ferric oxide according to the equation

$$2FeO+O=Fe_2O_3$$

The process according to the invention is based on the new recognition that even the crystalline magnesites rich in iron are absolutely suitable for the production of caustic burned magnesia provided that such oxidation of the ferrous oxide into ferric oxide is virtually prevented. This explains why the crystalline magnesites with increasing iron content become more and more unsuitable for the production of caustic-burned magnesia by calcination in the presence of air. It may be left undecided on what internal proceedings the result brought about by the present process depends. In all probability, the ferric oxide in nascent state catalytically promotes the conversion of the magnesia into a more and more dense condition, until at last the setting properties of the magnesia are altogether lost. However this may be, it has been ascertained that crystalline magnesites containing more than 2% of ferric oxide (reckoned on the residue on ignition) or even considerably more than that, when burned with practically complete exclusion of oxygen or with introduction of an inert gas such as CO_2, or of a reducing gas such as CO or H_2 behave exactly like amorphous magnesites, whereas the same crystalline magnesites under the influence of minute quantities of air yield products which, when calcined under gentle conditions, contain a considerable amount of undecomposed magnesium carbonate or, when more perfectly burned, contain large quantities of dead-burned portions or have even entirely lost their hardening properties.

The caustic burned magnesia has to meet different kinds of requirements according to whether it is to be used for the production of light-weight wood wool bricks or for the production of xylolite floors or the like made from mixtures of sawdust and Sorel cement. In the first instance the magnesia has to set quickly, whereas in the second case a longer setting time, about 4 to 6 hours, with good after-hardening is needed. When starting with crystalline magnesites the present process enables a just as flexible adaptation to the different requirements to be achieved as can be fulfilled when starting with amorphous magnesites.

The testing of the caustic burned magnesia which is intended for the manufacture of light-weight wood wool bricks, is carried out just as in the case of cement testing, by ascertaining the tensile strength. For this purpose, for example three parts by weight of magnesia are mixed with

one part by weight of sawdust made into a stiff paste with magnesium sulphate solution of 20°Bé, and pressed by hand into the known tensile strength molds, whereupon these molds are covered at both ends by glass plates and placed two by two in an iron pot with steam-proof closure. This pot is maintained at a temperature of 200°C for 20 minutes in a drying oven, whereupon the body to be tested is removed from the mold and immediately subjected to the tensile test. Whereas the ordinary Radenthein caustic burned magnesite with an iron content of 3 to 4% (as Fe_2O_3 calculated on the residue on ignition) shows after this period a tensile strength of 6 to 7 kg./cm_2, this strength rises to twice as much, that is to 13 to 15 kg/cm_2, when the present process is used. Thus, it has been made possible to make lean the caustic burned magnesia with cheap inert filling substances and in spite of the most sparing use of the binding medium to obtain even an improvement of the light-weight bricks.

In testing the caustic burned magnesia to ascertain its suitability for the purpose of making xylolite floors, the mixture of three parts by weight of magnesia and one part by weight of sawdust, tempered in this instance with magnesium chloride solution of 20°Bé, after having been pressed into the molds in the manner above described, is allowed to harden within the molds for 18 hours at room temperature, whereupon the specimens are removed from the molds and stored in the open air. The following table shows the results of the tensile strength tests after 1, 3, 7 and 28 days for test bodies of three different kinds of caustic burned magnesia, of which I was produced from Euboea magnesite, II from Radenthein magnesite in a rotary furnace with introduction of air, and III from the same Radenthein magnesite with the aid of the present process.

	Days			
	1	3	7	28
	Kg/cm²	*Kg/cm²*	*Kg/cm²*	*Kg/cm²*
I	30	47	55	65
II	15	25	40	50
III	38	50	60	65

Both the product from the amorphous magnesite poor in iron and also the product resulting a large percentage of dead-burned portions. according to the invention, showed a rapid rise in strength, which is extremely desirable for xylolite floor production; on the other hand, the product obtained by the ordinary rotary furnace calcining hardened but slowly owing to containing a large percentage of dead-burned portions.

The following comparative figures illustrate the setting time:

	Beginning	End
	Hours	*Hours*
I	2 to 3	4 to 7
II	1	3
III	2 to 3	5 to 7

Also in this respect the product of the present process is quite equivalent to that from Grecian magnesite. The late beginning of setting—in addition to the long setting time—is very desirable for the production of xylolite floors or the like, because it is thus possible to deal at once with a large bulk of the mixture without any danger of the moist mass partly setting already in the mixing through, which event, as experience has shown, would result in an noticeable deterioration of the flooring laid.

Also as regards storage property in ground state, the product obtained from the crystalline Radenthein magnesite when treated according to the present process, is quite as good as the best products from amorphous magnesites, whereas the caustic burned magnesia produced by the ordinary rotary furnace calcining under otherwise identical conditions on being stored adsorbs 4 to 5 times as much moisture as the caustic burned magnesia obtained from Grecian prime material.

Seeing that even small traces of air penetrating into the furnace are endangering the result aimed at, it is primarily the shaft furnace which is suitable for carrying out the process, since this furnace is capable of being perfectly tightened.

This process is also valuable for working up crystalline magnesites poor in iron which would produce good results even when calcined under air admission, for in this case the process enables the quality properties of the resulting products to be still further improved.

JOSEF BERLEK.

Published Apr. 27, 1943 Serial No. 280,527

ALIEN PROPERTY CUSTODIAN

PRODUCTION OF THREADS

Giovanni Campolunghi, Rome, Italy; vested in the Alien Property Custodian

No Drawing. Application filed June 22, 1939

When viscose is spun in an acid bath, gaseous substances, namely CO_2, H_2S, SO_2, CS_2, are evolved in considerable quantities.

Under the conditions which are usually maintained in the manufacture of artificial silk or cellular wool in order to obtain smooth and glossy threads, these volatile substances, which originate from the disintegration of substances contained in the viscose, in particular Na_2CO_3, $NaSO_3$, Na_2S, Na_2CS_3, and xanthogenate itself (which is split up into CS_2 and cellulose mass), are evolved relatively slowly and furthermore a tubular thread is formed in the first phase of the coagulation, through the still soft and plastic walls of which the gases diffuse out from the inside so that the thread is quite free from them when it has become solid.

In lengthy experiments, which have been carried out partly in the laboratory and partly on a semi-industrial scale, it has now been found that when the acid content is concentrated so that a sufficiently rapid formation and simultaneous fixing and hardening of the threads is obtained, by reason of which the gaseous products evolved remain enclosed in the precipitated solid substance, the phenomenon occurs that these gaseous products remain uniformly distributed in the interior of the threads in the form of microscopically small bubbles each of which forms a small hollow space after drying. Owing to the contraction of the swollen mass in the transverse direction and owing to the presence of the bubbles, there result projections and irregularities when such threads dry, and this gives the threads a somewhat wrinkled character on the surface. By reason of this property and the heat insulating effect, which is to be attributed to the internal structure being interspersed with numerous hollow spaces, a special character similar to that of natural wool is imparted to the thread produced.

A product having the above described characteristics is obtained if the viscose which is prepared in the normal manner for the production of artificial silk or cellular wool and which thus contains 8–10% cellulose and 6–8% Na OH is spun in baths which have an acid content exceeding 13% H_2SO_4. The acid content may be regulated in accordance with the fineness and the quantity of the hollow spaces desired to be distributed in the thread material. As baths suitable for the above purpose, the following are given by way of example:

(1)

	Grams
H_2SO_4 of 66° Be	230
Na_2SO_4 anhydrous	220
Water	550
Total bath liquid	1000

(2)

	Grams
H_2SO_4	150
Na_2SO_4	220
$ZnSO_4$	18
Water	612
Total bath liquid	1000

In the baths Na_2SO_4 may be replaced by $MgSO_4$ and further, in order to obtain the maximum possible acceleration of the complete coagulation of the thread, 10–50 grams of $ZnSO_4$ may be added.

The thread formation is preferably effected with stretching during spinning, the threads being guided over a pair of rollers running at a different speed before being wound on to spools or before being laid in spinning pots or before being united into bundles of threads.

Should an increased gas development be desired during the thread formation, there may be added to the viscose a certain quantity of Na_2CO_3 (for example 10% of the alpha-cellulose content) or other substances which pass into vapour at a spinning temperature of 45–50° C. However, in the case of this increased gas development there is a danger of obtaining threads which are partially tubular, which jeopardises the uniformity of the product, in particular with respect to subsequent dyeing properties.

By means of an addition of solutions of protein-like substances to the viscose used, products which can be dyed with acid dyestuffs can be obtained. This is obtained for example by adding to the viscose 5–10% of an alkaline solution of casein or of other natural proteins or similar synthetic substances containing nitrogen or containing sulphur. In this manner the new thread receives a very special resemblance to wool as well as the external and internal structure described and in spite of its softness and fullness.

GIOVANNI CAMPOLUNGHI

Published Apr. 27, 1943

Serial No. 283,290

ALIEN PROPERTY CUSTODIAN

COLLAPSIBLE BOAT

Willi Schütte, Berlin SW 11, Germany; vested in the Alien Property Custodian

Application filed July 7, 1939

The usual collapsible or folding boats consist of a watertight covering of rubber cloth or impregnated canvas, and an inner skeleton which takes to pieces. This skeleton consists of frames which do not take to pieces, and stringers or bottom parts which may take to pieces and are shaped like rods, or are connected by hinges so that they can be folded, and are shaped like boards. It is difficult to pack the frames and the longitudinal members or stringers and the like, impart only limited strength to the boat longitudinally. Erecting such a boat is tedious and requires great care, as otherwise the skeleton will occupy an oblique position in the cover. The usual small air reservoirs of rubber cloth afford but little safety against sinking of the boat when the boat becomes leaky.

Collapsible boats are also known in which the skeleton includes lateral structures subdivided by a longitudinal partition and connected by hinges. Under the pressure of inflatable rubber tubes arranged between the lateral structures and the covering, the structures act on the bottom of the boat and the deck bracing, and exert tension on the covering. The side structures do not extend as far as the stem and the stern post, but they only extend for one or more pitches of the frames and are not connected longitudinally to each other, so that the longitudinal strength of the boat is poor.

These drawbacks are eliminated according to the present invention which relates to a collapsible or folding boat with a foldable inner skeleton, a covering, and inflatable air tubes between the skeleton and the covering. According to the invention, the skeleton consists in substance of two elastic longitudinal members which are curved in their longitudinal direction, and solid throughout their height from the bottom to the deck of the boat. The longitudinal members extend from the stem to the stern of the boat, and bracing members are inserted between them. Arranged between the skeleton and the water tight covering are air tubes which extend all over the length of the boat. In this manner, the inner skeleton consisting of longitudinal members, transverse bracing members, and bottom boards, makes up a stiff body of rectangular cross-section which does not require transverse frames, is very strong in its longitudinal direction, and light. The covering is readily placed in the proper position on the body in untensioned condition and is imparted tension and the proper boat shape by inflation of the air tubes.

The longitudinal members, the bottom parts, and the longitudinal stringers—if any—below the bottom are subdivided, in the usual manner, by transverse partitions, and the individual units thus obtained are connected by hinges or turnbuckles of usual kind, so that their ends are in close engagement after they have been assembled.

Preferably, the air tubes are subdivided into compartments by suitable, air tight transverse partitions, so that a sufficient amount of buoyancy is present even if one of the compartments is damaged, preserving the transverse stability of the boat and preventing sinking.

All fittings, and especially the stern post, are preferably attached to the skeleton, so that the covering is clear of fittings.

The construction which has been described, with bracing members arranged transversely between the longitudinal members, is preferred for comparatively small boats. For larger boats, transverse members at the level of the deck are dispensed with by making the said longitudinal members at their upper sides with a plurality of bracing rails superimposed in the manner of lamellae, which are curved to the curvature of the longitudinal members and are then firmly connected to the longitudinal members under high friction, holding such members in the curved condition.

When it is desired to design the collapsible boat for the reception of an engine, the cross-sections of the air tubes may be adapted at the rear to a wide stern braced by a board.

In the accompanying drawings, boats of the two types aforesaid are illustrated by way of example.

In the drawings, Figs. 1 to 5 illustrate the first type, and Figs. 6 to 9 illustrate the second type. More particularly

Fig. 1 is an elevation of the boat, partly in longitudinal section.

Fig. 2 is a plan view of the boat, with the covering removed at the right for exposing the corresponding longitudinal member and the bracing members extending transversely thereto.

Fig. 3 is a cross-section of the boat.

Fig. 4 is a plan view of its cockpit frame, and

Fig. 5 is a sectional elevation of the boat's stern, drawn to a larger scale and showing the stern post and the rudder.

Fig. 6 is an elevation, and

Fig. 7 is a plan view, of the larger boat embodying the second type.

Fig. 8 is a cross-section of the boat, drawn to a larger scale.

Fig. 9 is a perspective illustration of the boat, viewed from the aft and from above, and showing the motor-supporting wide stern board.

Referring now to the drawings, and first to Figs. 1 to 5, a pair of longitudinal members *a* extend all over the length of the boat and are connected at their ends to the stem *d* and the stern *d'* by screws or other detachable means. The longitudinal members *a* are arranged in vertical, or substantially vertical, position, and are made of thin ply wood or some other suitable material. The upper edge of each longitudinal member *a*

is reinforced by a wooden rail a_o, and its lower edge is reinforced by a wooden rail a_u. Lower bracing members *c* are placed on the lower rails a_u and equipped with tenons at both ends. The tenons are inserted in holes in the two longitudinal members *a* and the bracing members *c* hold the elastic longitudinal members *a* spread apart in curved configuration, as shown in Fig. 2 for the longitudinal member *a* at the right. A bottom *b* including stringers and bottom boards is arranged below the lower bracing members c and secured by screws, turnbuckles, hooks, or the like, of usual kind. Upper bracing members *c'* are placed on the upper rails a_o of the longitudinal members *a* fore and aft of the cockpit frame *g* for holding apart the upper portions of the longitudinal members, and supporting the deck of the boat.

The longitudinal members *a* and the bottom parts *b* are subdivided into individual sections transversely, and the sections are connected by hinges *s*, as shown, instead of which other means, such as turnbuckles, metal sleeves, bolts or the like, not shown, may be provided. The connecting means must be so made that the edges of the sections forming the longitudinal members *a* or the bottom *b* are abutted squarely when assembled, and the sections cannot bend at the joints. Preferably, the joints are staggered in the longitudinal members *a* and in the bottom *b*.

A tight covering *e* is placed on the skeleton comprising the elements *a*, *b*, c, c', *d*, and *d'*. Preferably, the sides and the bottom of the covering are made of several layers of rubber cloth, and its deck portion is made of impregnated canvas.

The deck portion of the covering *e* has a central cockpit aperture with a wooden cockpit frame *g* which is divided and whose sections are connected in the usual manner. The sides of the cockpit frame *g* are supported by the upper rails a_o of the two longitudinal members *a*. The fore and aft ends of the cockpit frame *g* are supported by the longitudinal members *a* through roof-shaped cant rails *c''* and *c'''*, respectively. Ridge beams, as shown at *v*, Fig. 1, for the aft portion of the boat, extend to the stem *d* and the stern *d'* from the respective cant rails, and the ends of the beams are detachably connected to the corresponding elements by bolts, turnbuckles, and the like.

Inserted between the outer sides of the longitudinal members *a* and the covering *e* are inflatable tubes *f* of rubber or the like, with pointed ends. The tubes extend from the stem to the stern and are subdivided into any number of airtight compartments by partitions one of which is shown in dotted lines at *t* in Fig. 2 and which are provided with suitable check valves, not shown. The air tubes can be inflated by a blower.

A rudder bearing *h* is secured to the stern *d'*, Fig. 5, and a rudder pivot *i* is screwed into the bearing through a hole *k* in the covering *e*. When the pivot *i* has been inserted in the fitting *h* it is locked by a lock nut *u* and the boss of the rudder *l* is placed on the pivot *i*, the lock nut *u* acting in the manner of a step bearing.

When it is desired to assemble the boat, the sections of the longitudinal members *a*, the bottom *b*, and the stem and stern *d* and *d'* are inserted into the covering *e* and the tubes *f* are placed between the longitudinal member sections and the covering. The several sections are now connected, and the transverse bracing members *c* at the bottom, and *c'* at the deck, are inserted and secured, bending the longitudinal members *a* into the desired curvature. The cockpit frame *g* and the cant rails *c''* and *c'''* are now assembled and the tubes *f* are inflated. The rudder pivot *i* is threaded into the fitting *h*, and the boss of the rudder *l* is placed on the pivot. The rudder *l* is operated in the usual way by a yoke and cables.

Since the covering *e* becomes taut only upon inflation of the tubes *f*, the boat is very conveniently assembled. The skeleton makes the boat very strongly longitudinally but at the same time the skeleton is light, as it is without frames. The tubes *f* afford great safety against capsizing and sinking of the boat, give the boat a taut and smooth skin and are very resistant to lateral shocks. The rudder reactions are absorbed directly by the skeleton, and the covering *e* cannot be damaged by the rudder.

Referring now to Figs. 6 to 9, the general construction of this boat is similar to that which has been described with reference to Figs. 1 to 5, and similar parts are provided with the same reference numerals in all figures.

In this boat, which, as mentioned, is larger than the one previously described, the bottom boards *b* occupy the entire space between the longitudinal members *a*. The boards, which may be made of ply wood, are placed on the upper edges of the lower bracing members *c* to whose lower edges stringers are secured in the usual manner by screws, or the like.

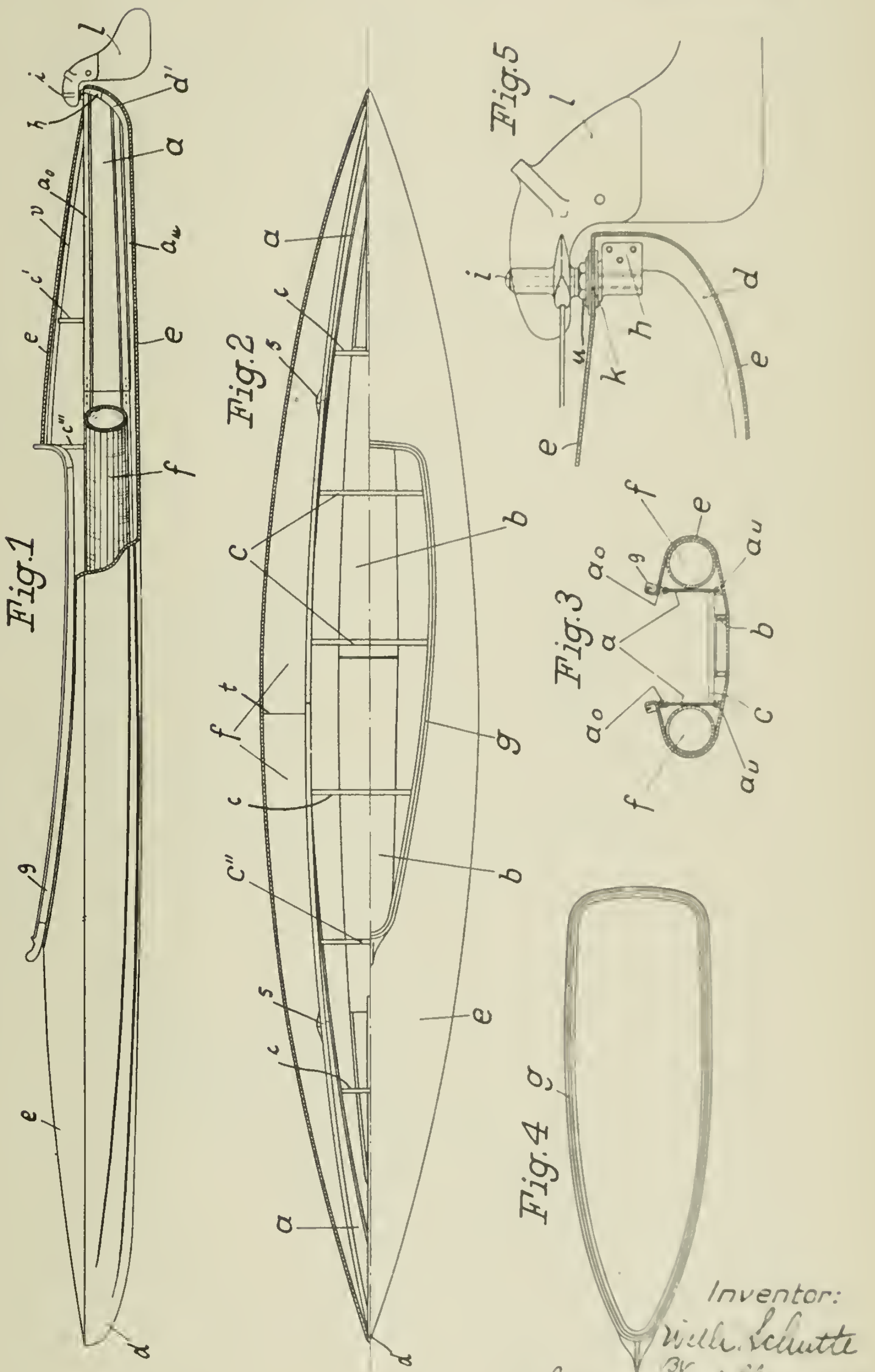
As mentioned, the upper bracing members *c'* are dispensed with here, and other means must be provided for imparting the desired curvature to the upper edges of the longitudinal members. Such means are a gunwhale at each member *a* which consists of an outer strip *m*, and an inner strip *m'*, of elastic wood. The strips are placed side by side like lamellae, and are straight when free. When the longitudinal members *a* and the lower bracing members c have been assembled, the two strips *m*, *m'* for each longitudinal member *a* are bent to the curvature of the members *a* and then are connected with great friction to the corresponding upper rail a_o against which they are held by screw bolts *n* equipped with wing nuts and extending through holes in the rail and the two strips. The strips *m*, *m'* and the rails a_o now make up a substantially rigid, curved beam and the bracing members *c'* may be dispensed with. The upper edge of the covering *e* is clamped between the rails a_o and the strip *m* at each longitudinal member *a*.

If it is intended that the boat should be motor-driven, the aft ends of the tubes *f* are made with their full diameter, as shown in Fig. 9, and a board *d''* is secured to the broad stern thus produced. A motor, not shown, can be attached to this board.

Boats of this second type can be made 10 metres long, and even longer, and provided with an outboard motor at the stern board *d''*. Detachable seats or folding chairs may be used.

WILLI SCHÜTTE.

PUBLISHED	W. SCHÜTTE	Serial No.
APRIL 27, 1943.	COLLAPSIBLE BOAT	283,290
BY A. P. C.	Filed July 7, 1939	2 Sheets-Sheet 1



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PUBLISHED	W. SCHÜTTE	Serial No.
APRIL 27, 1943.	COLLAPSIBLE BOAT	283,290
BY A. P. C.	Filed July 7, 1939	2 Sheets-Sheet 2

Fig. 6

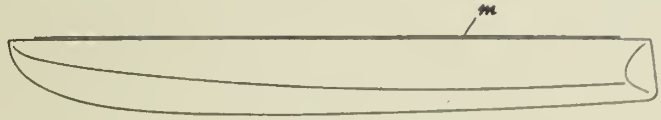


Fig. 7

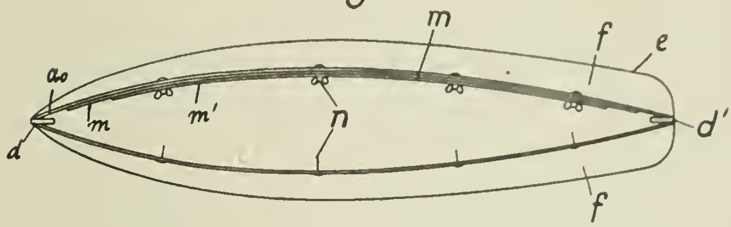


Fig. 8

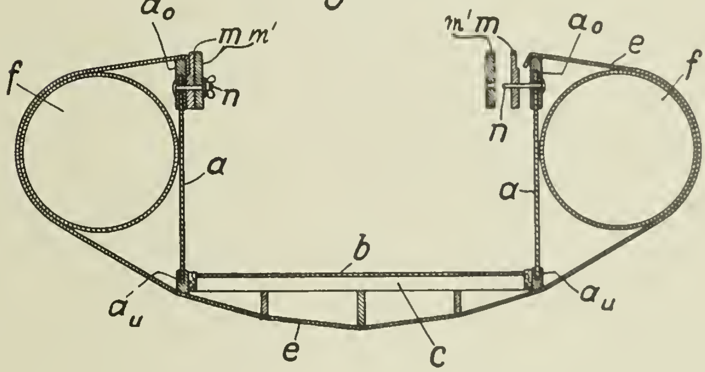
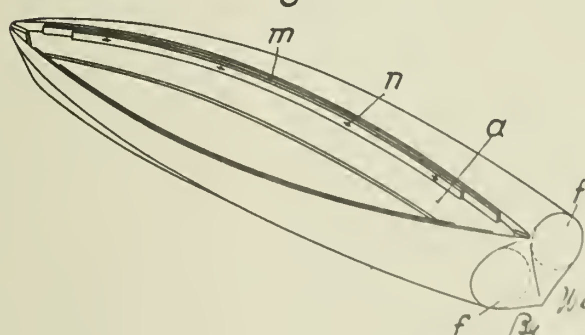


Fig. 9



Inventor:
Willi Schütte
By

Published Apr. 27, 1943

Serial No. 285,144

ALIEN PROPERTY CUSTODIAN

AUTOMATIC GUNS HAVING SLIDING BARRELS

Wolfgang Rossmanith, Solothurn, Switzerland; vested in the Alien Property Custodian

Application filed July 18, 1939

In automatic guns having a sliding barrel and a longitudinally movable breech block which is adapted to be locked thereto, devices are known for arresting the barrel in its rear end position until the return or running-out movement of the breech block, which block moves further back relatively to the barrel than the position in which the barrel and block are locked together.

These known arresting devices are generally locking levers mounted on the barrel and which, when the barrel is in its rear end position, drop into corresponding notches in the casing and fix the barrel in its rear position until the lever is swung out of the notches by the breech block during its running out movement. If these locking levers are not positively actuated the reliability of their action is doubtful, while known positively actuated arresting devices cause friction and stoppages by bearing against the rearwardly running breech block.

Thus, an automatic gun having an arresting device controlled positively by a driving lever which consists of an arresting lever connected rigidly with the driving lever has been proposed, in which case the lever and the breech block act directly on each other and maintain constantly their engagement with each other during the entire period of action of the gun, that is to say during both the recoil and the running out movements. If the barrel is subjected to a forward driving action, for instance by the barrel running-out spring or the effect of the weight of the moving parts when firing downwards, then the driving lever will be pressed against the backwardly running breech block with a resulting checking and frictional effect.

Furthermore, a barrel-arresting device is already known in which there is provided, on the driving lever, inserted between the barrel and the breech block an arresting member which arrests the barrel in its rear end position and holds it until the breech blocks runs out again.

Owing to its integral connection with the driving lever, the arresting member can arrest and lock the barrel only when it is in the rear end position. Thus the arresting member cannot prevent the barrel from moving forward again before the driving lever completes its action, and while the recoil movement of the breech block is still in progress, and therefore prevents the breech block from running into the locking position and being locked to the barrel.

The invention, overcomes the aforesaid drawback by means of an arresting device controlled positively by the driving lever, which, without friction or checking the movement of the breech block, ensures that the barrel shall be held reliably in the position necessary for locking with the breech block by an automatic checking action between the driving lever and the arresting device. According to the invention, with this object in view, the driving lever is arranged to actuate a separately mounted arresting lever into its arresting position by means of a control cam surface. By means of a suitable form of construction of the control cam surface it is ensured that the period of engagement of the arresting lever in the barrel persists during a part of the recoil path shortly before the beginning of the unlocking operation and until the end of the recoil movement of the barrel. Furthermore, checking action of the control cam surface of the driving lever on the arresting lever, ensures that in all circumstances a premature running-out of the barrel into its front end position is prevented and the arresting lever in its turn prevents accidental return of the driving lever, while during the running out movement of the breech block the arresting lever cannot move away before the locking position is reached. In order, when the breech block is initially withdrawn by hand for the cocking and loading of the gun, that the barrel and the driving lever shall make the same movement as when a shot is fired and the barrel shall join in the return movement into its rear end position, it is advisable to provide a separate projection on the driving lever which is carried along by the withdrawn breech block.

In the accompanying drawings, which show diagrammatically as an example of construction, an arresting device for automatic guns according to the invention.

Fig. 1 shows the parts in the firing position.

Fig. 2 shows the parts when the unlocking of the barrel commences;

Fig. 3 shows the parts during the subsequent acceleration of the breech block, and

Fig. 4 shows the parts at the end of the acceleration of the breech block.

Referring to the drawings, the breech block is connected, in known manner, with the barrel 1 which is slidingly mounted in the gun casing, for example by a locking sleeve which is adapted to turn during the common rearward movement of both parts. The barrel 1 and the breech block 2 may be arranged to run back against the action of special running-out devices or, as shown in the drawings, against the action of a common running out and closing spring 3.

Pivotally mounted in the gun casing on a pin

5 is a driving lever 4. This driving lever co-operates with a barrel arresting lever 6 which is adapted to pivot about a pin 7 and has projection 6*a* which slides on a cam surface 4*b* of the driving lever 4. Stops 8 and 9 limit the rotation of the lever 4 in both the clockwise and anticlockwise directions.

The barrel or the end of the barrel casing 1 has a projection 1*a* the rear surface of which strikes, during the rearward movement of the locked-barrel, against a surface 4*a* on the lever 4 and thereby causes the lever-arm nose 4*d* to swing into position in front of a shoulder 2*a* on the breech-block. These movements occur immediately prior to the unlocking of the breech-block 2 from the barrel 1, the parts being then in the position shown in Fig. 2. The breech-block is thereafter moved rearwards by the driving lever, while at the same time the barrel projection 1*a* slides on the surface 4*a* which is so shaped that the effective leverage of the barrel about the pivotal support of the driving lever is continuously reduced, whereas the lever-arm nose 4*d* acts upon the shoulder 2*a*, with constantly increasing leverage, so as to ensure an increasingly accelerated rearward movement of the breech-block 2 relatively to the barrel 1.

When the driving lever 4 is engaged between the end surface of the barrel and the shoulder 2*a* on the breech block (as shown in Fig. 2), the nose 6*a* of the arresting lever 6 slides on the cam surface 4*b* of the driving lever 4 and is positively adjusted thereby in such a manner that the nose 6*b* engages behind the projection 1*a* on the barrel. During the continued movement of the driving lever 4, the diameter of the part of the cam surface 4*b* which is engaged by the nose 6*a* increases after the manner of a spiral, and so the nose 6*b* is more and more lifted on to the barrel-arresting surface (Fig. 3) until finally the lever 4 turns into its end position (as shown in Fig. 4) and the barrel 1 has arrived in its rear end position, also shown in Fig. 4. The barrel 1 will now be held securely in its rear end position by the lever 4 while the breech block, owing to the kinetic energy transmitted thereto by the barrel 1 by way of the lever 4, runs back alone. A reversed motion, i. e. anti-clockwise motion, of the lever 4 and, therefore, a forward movement of the barrel 1 is prevented by the automatic checking effect of the pitch of the cam surface 4*b* and, if desired, the pitch of the cam surface 4*a* which bears against the rear end surface of the barrel may be formed to co-operate with the surface 4*b* to hold the lever 4. Only when the breech block 2 runs back into the barrel 1 which is arrested in its rear end position does the lever 4 swing the arresting lever 6 gradually out of its barrel-locking position. The duration of the period of engagement of the lever 6 until the final release of the barrel occurs is, in this case, so selected that a sliding of the arresting lever nose 6*b* from the barrel projection 1*a* is not completely ended until the locking of the barrel and block has already begun. The barrel 1 and the breech block 2, the locking having in the meantime taken place, then move together into the firing position shown in Fig. 1.

In order, during the initial cocking of the gun by the withdrawal of the breech block 2, that the barrel 1 be returned into its rear end position, the lever 4 is provided with a projection 4*c* against which a projection 2*a* on the breech block 2 bears when it is withdrawn, so that the lever 4 and the arresting lever 6 are adjusted in the same way as is the case during automatic firing.

WOLFGANG ROSSMANITH.

PUBLISHED
APRIL 27, 1943.
BY A. P. C.

W. ROSSMANITH
AUTOMATIC GUNS HAVING SLIDING BARRELS
Filed July 18, 1939

Serial No.
285,144

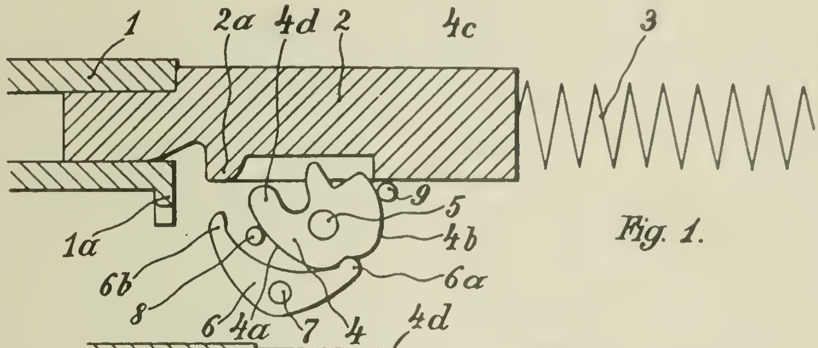


Fig. 1.

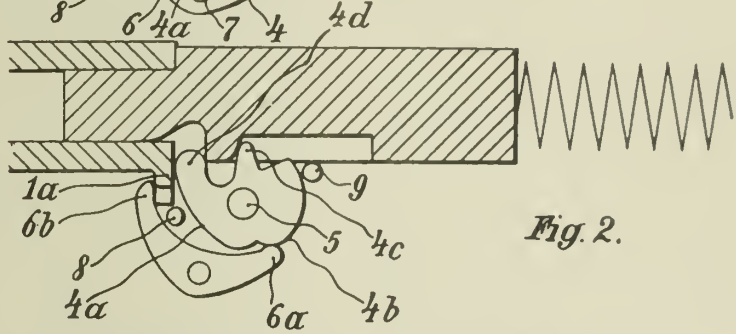


Fig. 2.

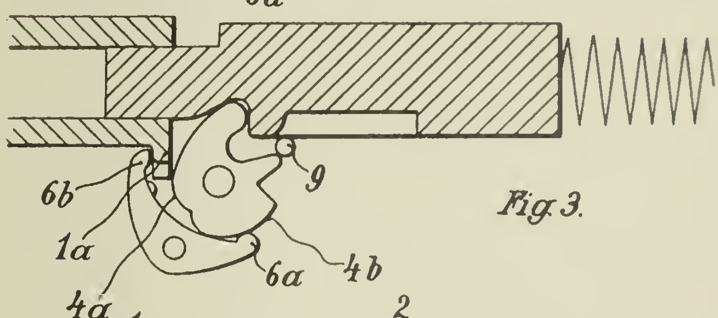


Fig. 3.

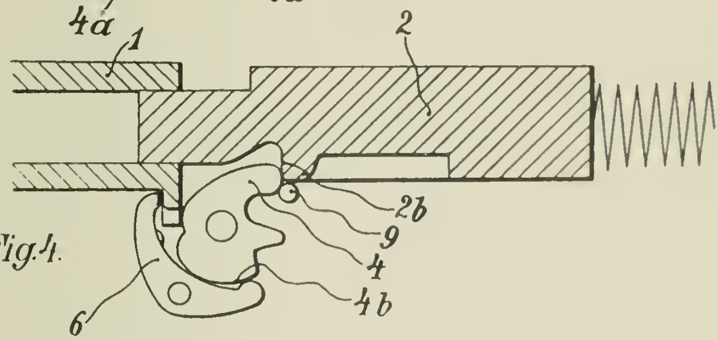


Fig. 4.

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Published Apr. 27, 1943

Serial No. 285,434

ALIEN PROPERTY CUSTODIAN

SAFETY DEVICES FOR GAS CONDUITS

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Application filed July 19, 1939

To prevent explosions in gas conduits, water-traps are usually employed. In this way the formation of an explosive mixture in the gas supply conduit is prevented in that the water-trap prevents the penetration of air or oxygen into the gas supply conduit from the point of consumption, and on the other hand should such an explosive mixture exist in the supply conduit the flame is prevented from striking back in the conduit in that the stream of gas flowing through the water-trap is subdivided into discontinuous bubbles. The disadvantage of the water-trap is a considerable pressure loss, a picking-up of water which must be limited by complicated baffle plates and the like but which cannot be wholly eliminated, large gas chambers which involve large dimensions and thicknesses of metal for the containers and thus involve considerable expense, the danger of freezing, and the necessity for a constant supervision for checking and maintaining the water content.

The object of the invention is to provide arrangements which afford the same security as the water-traps but avoid the disadvantages wholly or in part.

The invention is based on the known fact that on igniting a gas mixture at one point in a closed conduit there is an increase of pressure in the adjacent mixture which is not yet ignited, i. e. the flame front is preceded by a pressure wave in the gas which is not burning. This preceding pressure is utilised in accordance with the invention to urge a medium (a solid body such as a valve, a liquid or a gas) into the gas conduit at a safety device disposed at some distance from the point of ignition. In this way the flame is prevented from penetrating into that part of the gas conduit which is to be protected, provided that the time difference between the incidence of the pressure wave and the incidence of the flame at the safety device is greater than the time necessary for the complete closure of the gas conduit and if in addition the reopening of the gas conduit is prevented before the flame is extinguished.

With many gases and gas mixtures, the normal conduit from the point of consumption to the safety device is sufficient in respect of length, cross section, walls, structural material and contour, in order to ensure the above-mentioned adequate time difference. When this is not the case the necessary time difference must be produced by separate means in a part of the conduit or throughout the conduit. A known means for effecting the delay in the propagation of the flame consists for example of a reduction in the cross-section of the conduit over a limited length whereby the speed of the gas mixture flowing in the opposite direction to the direction of propagation of the flame is increased, a subdivision of the gas stream and of the heat transfer in vessels which are filled with a porous material, metal chips, glass wool or the like, a cooling of the conduit, a sudden enlargement in cross section, and in some circumstances an elongation of the path by incorporating a helix or the like.

If this retardation conduit independent of the actual safety device does not afford a sufficient time difference between pressure wave and flame, then the time which elapses from the incidence of the flame at the beginning of the safety device up to the incidence of the flame at the inlet of the conduit which is to be protected can be increased by causing the flame to traverse a circuitous path incorporated in the safety device. To utilise the preceding pressure wave in its entirety for closing the conduit which is to be protected, the escape of the pressure in this circuitous path is best prevented by a non-return valve.

Figs. 1 to 3 of the accompanying drawings show diagrammatically the fundamental principle of the arrangements according to the invention.

According to figure 1, the gas (acetylene, coal-gas or the like) passes from the source 1 into the supply conduit 2 and to the safety device 3 and from thence through the delivery conduit 4 to the point of consumption 5 (welding burner, cutting burner, hardening plant, gas fired system or the like). If there is striking back from the point of consumption 5, the flame is arrested by the safety device which is prevented from reopening.

In Fig. 2 the conduit 4 is constructed as a flame retarding conduit.

In Fig. 3 a flame retarding circuitout path 7, 8 is incorporated in the safety device, a device 8 for preventing loss of pressure being provided at that end of the circuitous path which is adjacent the consuming device. At the same time the conduit 4 may also be constructed as a flame retarding device.

An example of a flame retarding device 6 or 7, is shown in figures 2*a* to 2*c*. Thus for example in figure 2*a* a body which fully fills the conduit but is permeable is incorporated in the conduit 4. This body consists for example of a core 6*a*, about which two very thin strips 6*b* and 6*c* are wound spirally. These strips bear against the core 6*a* on the inside and against the inner wall of the conduit 4 on the outside. One strip 6*b* is smooth. The strip 6*c* is broader than the strip 6*b* and is provided with straight or curvilinear openings 6*e* or 6*f* (fig. 2*b*) extending substantially over its entire width. As these openings 6*e* and 6*f* are longer than the strip 6*b* is wide, they project beyond the edges of the strip 6*b* on both sides when the strips are coiled, and thus form a narrow passage for the gas. The very fine passages for the gas in the body formed from the strips

6b and 6c considerably retard or entirely prevent the propagation of the flame.

According to Figure 2c, the two strips 6*b* and 6c could be replaced by a single strip 6*g*, one side of which is plain and the other side of which is provided with projections, ribs or the like 6*h*. These projections then lie against the smooth side of the strip 6*b* when the latter is coiled. The fine passages for the gas then lie between these projections, which can be of any desired configuration.

For the sake of clarity, the scale has been very much enlarged in the representations of this device. In practice the gas passages formed by the openings 6*e* and 6*f* or the projections 6*h* have a cross section of only a few hundredths of a square mm.

Figs. 4 to 7 show by way of example a safety device in which a solid body, namely a valve 9 prevents the propagation of the flame and a diaphragm valve 10 prevents the penetration of oxygen.

During operation the gas supplied at a pressure p_1 flows through an opening in the tap 11 into the chamber beneath the diaphragm 10, lifts it and passes into the conduit 12, urges the valve 9 against its upper seating and then flows through the openings 13 in this valve into the conduit 14 which leads to the point of consumption.

The chamber above the diaphragm 10 is connected with the conduit 12 by way of conduit 15. During the flow of the gas the ejector mounted on the conduit 15 gives rise to a reduced pressure in comparison with the supply pressure p_1, so that the diaphragm 10 is constantly maintained in the raised position.

In order that the valve 9 should close as quickly as possible, it is made particularly light and with a particularly short stroke and is connected directly to the delivery pipe without any enlargement in cross section of this delivery pipe. The valve plate is arranged at right-angles to the direction of flow and is provided with gas passages which extend obliquely upwardly. The incident pressure wave preceding the flame is thus utilised fully for the rapid closing of the valve plate so that a flame which is only slightly retarded relatively to the pressure wave encounters a closed valve.

The reopening of the valve 9 is prevented by means of a retaining device disposed beneath the valve. This retaining device is so arranged that it does not prevent the free movement of the valve between its upper and lower seatings but first operates when the packing 16 is compressed somewhat. This packing must be very elastic in order that the valve plate should be held even with a pressure wave of small intensity. It suitably consists of a moss rubber with an impervious rubber layer on the outside.

The retaining device has two resilient clamping jaws 17 which are urged together by means of the spring 18 and are held at a minimum separation by means of the tube 19. When the valve plate is urged against the rubber seating the points of the clamping jaws engage the grooves 20 on the stem of the valve.

The retaining device is released manually by turning the shaft 21, which is mounted in a stuffing box. On releasing the shaft, the trip member on this shaft is restored to the position shown by spring means.

Fig. 5 shows a construction with an auxiliary flame retardation by means of a circuitous path. The valve plate is secured to a spring diaphragm 22 and a circuitous path with a ball valve 23 and a coil 24 is arranged between the delivery pipe and the valve opening. If, in the rest position, the valve plate lies on its seating and is raised by the gas pressure, then the action of the pressure wave preceding the flame assists the spring action of the diaphragm and rapidly closes the valve. The ball valve 23, which could be replaced by a spring loaded plate valve, prevents the pressure wave from being dissipated.

Instead of the coil 24 (Fig. 5) extending the path of the flame, the arrangement according to Figure 6 incorporates a cartridge 25 filled with a permeable medium which at the same time reduces the dissipation of pressure and retards the flame. Both effects are assisted by the provision of the flow-obstructing device 26, at which the direction of flow is changed. Such an obstruction to flow can be provided in the embodiment according to Figure 5 in place of the valve 23.

Instead of the bellows-like diaphragms shown in Figures 5 to 6, flat diaphragms could be employed.

The valve 9 does not prevent the penetration of oxygen in all cases which arise, because with approximate equality of the pressure in the oxygen and in the working gas, the valve assumes a condition of unstable equilibrium in which there is a chattering of the valve plate so that oxygen can penetrate back into the supply pipe.

In order to prevent the penetration of oxygen even when the valve is in a state of unstable equilibrium, a non-return valve loaded by its own weight or by some other force must be incorporated. If the supply pressure p_1 is not sufficient to lift such a loaded valve or if the considerable pressure drop which arises on opening the valve is an impedance, then the necessary lifting force is preferably supplied by a diaphragm. Such an arrangement is shown in Figure 4.

If oxygen passes in the direction of the broken line arrow into the conduit 15, then the diaphragm 10 is lowered and the diaphragm valve is closed when a pressure p_2 is reached above the diaphragm. Due to the loading by the weight 27 the pressure p_2 is appreciably below the pressure p_1. Even if the diaphragm chatters when in a condition of unstable equilibrium, the passage of oxygen into the supply chamber is not possible because the low pressure oxygen cannot penetrate into the supply chamber which is subjected to a higher pressure.

The diaphragm cannot be damaged because the flame and also the pressure of the explosion is trapped by the valve 9.

This safety device satisfies all requirements provided that the diaphragm 10 is gas-tight and the diaphragm valve seating also gives a reliable closure. If, on the other hand, the diaphragm leaks, for example due to ageing of the material constituting the diaphragm, or if foreign bodies become deposited between the diaphragm and the diaphragm seating, then when oxygen passes back in the conduit 12 there will be a further passage of oxygen into the supply chamber as soon as the pressure of the oxygen is higher than the supply pressure p_1 in 28. This condition will not be apparent to the attendant.

To avoid this dangerous condition, which can be eliminated only in part (namely in respect of ageing only) by using a metal bellows instead of a diaphragm 10, the non-return valve 29 leading to the surrounding atmosphere and shown in dotted lines in Figure 4 can be incorporated, the spring being so adjusted that the valve opens at

at a pressure p_3 which is slightly above the pressure p_2 and considerably below the pressure p_1. In this way the pressure of the oxygen can never reach the magnitude of the supply pressure and thus even in the case of leaks no oxygen can pass to the supply chamber.

The operation of the device presupposes a constant pressure p_1. Where such a constant pressure is not present a valve must be employed the opening of which is not determined by the pressure p_3 but by the difference in the pressures p_1 and p_2.

An example is shown in the valve represented in Figure 7 which is controlled by pressure difference. The chamber 31 beneath the diaphragm 32 is connected by way of the pipe 30 with the chamber beneath the diaphragm 10 and the chamber above the diaphragm 32 is connected by the pipe 33 with the chamber above the diaphragm 10. The diaphragm 32 is loaded by the weight 34 which is provided at its base with a number of grooves 35. The weight is so chosen that there is a condition of equilibrium at the diaphragm when the pressure p_3 above the diaphragm is somewhat greater than p_2 and is substantially less than p_1. Consequently any oxygen travelling back in the conduit escapes into the surrounding atmosphere through the opening 36 when the pressure p_3 is exceeded.

If in special cases and in contradistinction to the assumption hitherto made, the operating gas is at a pressure sufficient for opening a simple non-return valve subjected to a considerable load and if the resultant pressure loss is tolerated, then the diaphragm valve 10 shown in Figs. 4 and 7 can be replaced by a simple plate valve or by means of a teat valve 37 according to Fig. 8.

In order to prevent the passage of oxygen even with leaks in such a valve, according to the invention the non-return valve 29 which leads to the surrounding atmosphere and is indicated in dotted lines is incorporated, or if the supply pressure varies, a valve according to Fig. 7 which is controlled by means of the pressure difference is provided and the connections therefor are indicated at 30 and 33 in Fig. 8.

The arrangement of a non-return valve leading to the outer atmosphere is certainly known but in this known arrangement the oxygen creates an excess pressure in the space between the tap at the point of consumption and the inlet valve corresponding to the valve 9, with the result that this valve 9 is closed and the non-return valve leading to the surrounding atmosphere is opened. This excess pressure must be greater than the working pressure opening the inlet valve and thus the passage of the oxygen is not prevented during the condition of unstable equilibrium at the inlet valve.

In the embodiments according to Figs. 9 to 12, the passage of oxygen is not prevented by a separate mechanical device but by providing a liquid seal at the valve which prevents striking back. The device for holding the valve in the closed position then becomes superfluous. The equivalent water column of the liquid seal need only be small as the water or other liquid is to serve substantially only as a seal preventing the passage of oxygen. The pressure loss and the amount of water carried along by the gas stream are therefore very small in comparison with the usual water-traps.

In the embodiment according to Fig. 9 the liquid stands at the same level in the gas supply tube 39, in the extension of the tube 40 leading to the point of consumption and in the gas space 41 during the rest condition. On opening the closure device or tap at the point of consumption the gas flowing into the supply pipe 39 urges the liquid beneath the rising valve plate 42 into the space beneath the apertured distributor 43 and the gas then flows through the liquid seal and beneath the raised ball 44 into the tube 40. If the flame strikes back the ball 44, which can be replaced by a device impeding the flow according to Fig. 6, prevents the leading pressure wave from passing into the space 41 so that the full pressure acts on the water above the valve plate 42 or on this plate itself and forces it against its seating. A valve holding device is not necessary because if there should be any rebound, only water free from gas would penetrate into the supply pipe. When the device is acting to prevent rearward passage of oxygen, the valve plate 42 prevents the water content from running into the supply pipe.

Fig. 10 shows a construction similar to that of Fig. 9 but provided with the bellows 45 and the circuitous path 46. If with the safety device according to Fig. 9 a circuitous path were provided, there would be the danger that if the valve plate did not fit completely tightly against the delivery pipe 40 the water would be displaced into the delivery pipe 40 from the space 41 due to the increased pressure in this space due to the resistance to flow through the coil constituting the circuitous path. The flame could then pass directly from the conduit 40 through the gas bubbles rising in the water above the plate 42 and into the conduit 39. This danger is avoided by the incorporation by the bellows 45 which permanently closes the lower end of the delivery pipe 40.

In the embodiment according to Fig. 11 the spring diaphragm 47 carries a plate 48 the peripheral edge of which extends round the valve plate 49. During normal operation this valve plate is raised by the gas stream until it is arrested by the pin 50, so that there is a water cushion between the plate 43 and the valve plate 49. If striking back ocurs, the disc 49 is depressed and simultaneously surrounded by an annular jet of water so that it is impossible even during the downward movement of the valve plate for a flame which has already passed through the water seal to penetrate to the supply conduit 51. To prevent gas from entering the plate 48 while gas is flowing through the valve, the lower edges of the valve plate and of the plate 48 are cut off obliquely. For the sake of security a hole may be provided at the top of the plate 48 so that any individual gas bubbles which enter in spite of the oblique edges can escape from the plate 43.

In the constructions according to Figs. 9 to 11 there exists the possibility of liquid being carried along by the gas as the gas bubbles through, although due to the small depth of liquid the amount which is carried along is not considerable.

Fig. 12 shows a construction in which the prevention of the passage of oxygen is also effected by a sealing liquid but the possibility of liquid being carried along by the gas stream during the normal operation is eliminated. The arrangement and mode of operation is similar to that of Figs. 9 and 10 but the space which in Fig. 9 is indicated by 41 is divided by a partition 52 into two chambers 53 and 54 which communicate with one another above and below the partition. When gas is passing through, the liquid is dis-

placed into the chamber 53 so that the condition shown in Fig. 12 is obtained. The gas thus flows in the dry condition through the safety device to the point of consumption. The difference in level of the liquid in the chambers 53 and 54 corresponds to the resistance to flow on the path of the gas through the chamber 54. To prevent the liquid from overflowing at the top of the chamber 53 even with the maximum passage of gas, a ball 55 floating on the surface of the liquid is provided in the chamber 53. It closes the upper outlet of the chamber at the maximum liquid level. When an explosion occurs the valve plate 56 which is secured to a spring diaphragm is closed, and in the meantime water flows from the chamber 53 up to the level of the valve plate so that the flame cannot penetrate to the conduit 57. The displacement of water into the conduit 57 due to the penetration of oxygen is prevented by means of the ball float 58. In place of this ball, a valve plate according to Fig. 10 can be provided or circuitous path with coils or devices impeding the flow in accordance with Figs. 5 and 6 could be incorporated.

Figs. 13 to 24 show examples of safety devices in which the propagation of the flame is prevented by a liquid column which extends into the supply pipe and the passage of oxygen is prevented by a liquid trap.

In the examples according to Figs. 13 to 20 the passage of the gas through the liquid during normal operation is avoided. The disadvantages of the gas passing through the liquid have previously been mentioned. These safety devices are constructed as closed pipes having two communicating limbs and in one limb the gas supply pipe is connected at a point immediately below the water level in the rest condition, and the conduit leading to the point of consumption extends into the other limb at the top. If necessary, further arrangements could be provided in the path of flow of the gas within the device in order to retard the equalisation of pressure and the propagation of the flame. Such arrangements may comprise a coil, wire gauze, porous bodies, valves or the like.

In Figs. 13 to 15, the safety device according to the invention is constructed fundamentally as a closed tube 60, in one limb 61 of which the gas supply pipe 62 terminates immediately below the water level 63, and the pipe 65 leading to the point of consumption projects from the top into the other limb 64.

In the rest position the gas supply pipe 62 is closed by the water content of the safety device. In normal operation the gas flows through the supply pipe 62 and depresses the water level in the limb 61 of the tube 60. The water level in the limb 64 of the tube 60 rises correspondingly, without however reaching the opening of the pipe 65. The gas thus flows from the pipe 62 in the direction of the arrow (Fig. 14) to the pipe 65 and through the latter to the point of consumption. If the flame should strike back, then as shown in Fig. 15, the pressure preceding the flame operates directly on the raised water surface in the limb 64 of the tube 60 and depresses it, as due to the projection of the pipe 65 into the limb 64, the spreading of the pressure to the conduit 62 is retarded. The water level in the limb 61 of the tube 60 is therefore raised and thus the gas supply pipe 62 is closed. The flame which then arrives can consequently not pass to the gas supply pipe 62. Inside the safety device, devices of the kind already mentioned may be provided in the path of flow of the gas as shown in Fig. 16 for further retarding the spread of the pressure to the water in the limb 61 or for retarding the propagation of the flame along the same path. The device may for example be constituted by a coil 66, as indicated in Fig. 16.

In the embodiment according to Fig. 17 the gas supply conduit 62 enters the closed jacket 71 below the water level in the rest condition. Provided in the jacket 71 is a tube 72 which is open top and bottom and into which the conduit 65 which leads to the point of consumption projects from the top.

In the embodiment according to Fig. 18 the tube 74 which is open at the bottom is surrounded by the jacket 73 only up to about the level of the gas inlet and the jacket 73 is connected with the upper end of the tube 74 by means of a pipe 75, if desired, with a device for impeding the flow or with other retarding devices, e. g. a coil 76. The conduit 65 leading to the point of consumption extends into the upper end of the tube 74.

Fig. 19 shows another embodiment of the gas supply conduit 62. To ensure with complete certainty that the gas supply pipe 62 is closed by the water column which is urged suddenly in the limb 61 of the device when the flame strikes back, a deflector device 80 may be provided in the safety device in association with the gas supply pipe 62 in the form of a projection, a downwardly sloping deflecting plate or the like. This deflector ensures that a part of the water column which is suddenly urged upwardly is deflected into the gas supply conduit 62 and closes it.

To prevent the gas supply conduit 62 being opened by the falling water column in the limb 61 before the flame is extinguished, the supply conduit 62 can be in the form of a water trap 81 in front of its entry into the safety device and the water seal formed by the initial upward movement of the water in the safety device remains in this trap 81 until the gas stream again flows through the safety device to the point of consumption.

To prevent excessive displacement of water into the conduit 62 if striking back occurs, irrespective of whether a water-trap 81 is provided in the conduit 62 or not, a valve opening only in the direction of normal flow, e. g. a floating rubber ball 77 is provided in the conduit 62. The valve seating 78 is arranged above the rubber ball 77 and arranged below it is a retaining device, e. g. a grid 79, which prevents the rubber ball from being urged into the safety device during the normal operation. This rubber ball also serves to prevent water from flowing into the supply pipe if oxygen is passing back through the device.

If the tap at the point of consumption is suddenly opened or if the gas consumption is uniform but unusually large, there is the danger that the water in the limb adjacent the delivery pipe will rise to the level of the delivery pipe and will be carried along by the gas. To prevent this a ball 82 floating on the surface of the water is provided, which when the water level rises encounters the seating 83 and prevents the water level from rising further. At the same time this ensures that the water level on the gas inlet side always remains immediately below the inlet so that if there is striking back, the water has only to be raised a little in order to close the supply pipe quickly. Water escaping past the rubber valve flows through a small aperture 84 back into the inlet limb.

To avoid defective operation due to leaks at

the rubber ball valve, this valve can be replaced by a metal bellows which during normal operation dilates under the action of the water which is forced into it and contracts when there is striking back so that the water is forced out of the delivery limb into the inlet limb.

Fig. 20 shows a safety device of the same nature as Figs. 13 to 15 but with the gas supply pipe introduced through the top and with an auxiliary float device which permits gas to be drawn off at the point of consumption only when there is sufficient water in the safety device.

The gas supply pipe 62 is provided at its lower end with a valve seating opposite a valve seating between the limb 61 and the tube 60. In the normal operation the gas depresses the ball float 67 and passes through the limb 61, the opened valve 68 and the opened valve 69 to the delivery pipe 65. Valve 68 is loaded by a light spring and is intended to prevent the pressure wave from passing directly into the limb 61. The valve 69 is also closed in the rest position. It is opened by a float 70 provided in the limb 64 when the float is raised by the water rising in this limb during the normal operation. If striking back occurs the water and the float in the limb 64 are depressed and the ball 67 is urged against the upper valve seating by a jet of water. Any gas penetrating through leaks at the ball valve passes only in individual bubbles through the limb 64 in the upward direction so that the flame cannot strike back through the limb 64. If necessary a distributor 94 provided with a number of apertures can be provided.

In the examples according to Figs. 21 to 24, in order to increase the reliability, the passage of the gas through water is retained as in existing water traps but the depth of water can be made less than in the known arrangements because only an additional safeguarding is sought. Consequently the loss of pressure and the amount of water carried along by the gas stream are maintained very small.

In the embodiments according to Figs. 21 and 22 a funnel-shaped member 86 is arranged above the water space 85 corresponding to one limb of the communicating tube. This funnel, together with the corresponding cover of the device, forms the inner continuation of the delivery pipe 65 down to the water level in the annular space which is filled with water free from gas. It is important that the cross section is kept as small as possible in order to avoid a reduction in the magnitude of the pressure wave.

In the embodiment according to Fig. 21 the gas supply pipe 62 which is attached to the bottom of the container is provided with gas outlet openings 87 at its lower end. Arranged above these openings is an obstruction 88 which prevents excessive passage of water into the conduit 62. Further, the supply pipe 62 carries a distributor plate 89 below the level of the water in the rest condition. This distributor extends up to the partition 90. The base member 91 is attached to the bottom of the partition 90.

In the embodiment according to Fig. 22 the supply conduit 62 is constructed inside the apparatus to constitute a gas distributor 92 above which an obstruction 88 is provided in the conduit 62. The supply pipe 62 is open at the bottom and the partition 90 is connected thereto by means of the base member 91 so as to prevent upward displacement of the water which is subjected to pressure and is not traversed by gas. Communication is afforded by a few openings 93 in the partition 90.

Whereas in the examples of Figs. 21 to 22, the pressure wave is caused to operate on an external annular surface, in the examples of Figs. 23 and 24 it is applied to water in a separate receptacle. The water receptacle is provided with a container which is filled with water free from gas and has only a small gas space and communicates with the water container by means of a small aperture in the water space. The conduit leading to the point of consumption extends into the container at right-angles to the water surface. The water for forming the liquid seal is derived from this container. The container is in communication with the gas space of the safety device only by way of a small opening, e. g. an annular slot.

In the embodiment according to Fig. 23, the gas passes out of the supply pipe 62 at 95 into the water and if desired through a distributor 97 into the gas space. From there it passes through the pipe 65 to the point of consumption. A pipe 99 branches from the gas supply pipe 62 at 98 and projects farther into the water than the gas supply pipe. The pipe 99 is surrounded by a separate vessel 100. The water in this vessel is in communication with the water in the main container, for example by way of a small hole, 101 in the dividing wall. When striking back occurs, the pressure which is applied through the pipe 65 operates in the first place on the water in the vessel 100. This water is not permeated by gas bubbles and thus is not compressible Consequently water is forced immediately through the pipe 99 to the point 98 so that a water seal is formed there. At the top the container 100 has a small opening in the form of an annular gap. Here the pressure wave preceding the flame is propagated at a reduced rate into the gas space and then forces the gas impregnated water through the opening 95 into the tube 62 up to the point 98. Here in the meantime the seal with water free from gas has been produced so that the flame cannot travel further. The reduced spread of the pressure occasioned by the annular gap can also be obtained by incorporating a one-way valve.

A retardation of the penetration of the gas laden water to 98 can be obtained by increasing the length of the gas supply pipe between 98 and 95, e. g. by incorporating a coil.

In the embodiment according to Fig. 24, distributor arms 102 into which the gas flows at 103 are attached to the gas supply pipe 62. The upper sides of these distributor arms are provided with apertures through which the gas emerges into the water. Below 103 the gas supply pipe has a tubular extension 104 which is open at the bottom. The pressure wave urges water free from gas from the container 105 through the tubular extension 104 and past the openings 103 up to the obstructing device 106 so that a water seal is obtained at 107.

Here also the penetration of gas-laden water to the point 107 can be retarded by lengthening the path from 107 to 103 or from 103 to the gas outlet apertures, e. g. by incorporating a coil.

Whereas in all the examples of Figs 13 to 24 a communicating liquid seal is utilised the construction according to Fig. 25 shows a single liquid seal.

The compressible vessel 121 which is filled with liquid and which can consist of a resilient diaphragm 122 with an end plate 108, or a rubber

ball or a cylinder and piston or the like, is compressed by the pressure wave travelling through the conduit 65 from the point of consumption in advance of the flame when striking back occurs. The conduit 110 is closed by the valve 111 so that the entire pressure is utilised for compressing the vessel 121. Due to the pressure, the balls 112 and 113 are urged against their seats 114 and 115 and the liquid fills the space between these two seats. The flame subsequently arriving through the conduit 110 can thus no longer pass into the conduit 62. When the pressure is released the spring diaphragm expands again and draws in the sealing liquid again so that the safety device is again ready for operation because the balls 112 and 113 also revert to the rest position. The ball 111 is a light ball which is raised and held up by the working pressure applied through the conduit 62.

Fig. 26 shows a modification of the construction according to Fig. 25, by which the penetration of oxygen is prevented. The mode of operation of the floating ball 67 is the same as in the embodiment according to Fig. 20. In the rest condition the ball bears against the upper seating. It is depressed by the flowing gas and the water passes into the bellows 122 which expands accordingly. This expansion of the bellows is occasioned by the difference between the pressure operating at the upper opening 125 and the reduced pressure at the lower surface of the bellows due to the ejector 109. A nozzle can be incorporated in the opening 125 in order to produce a jet of water extinguishing the flame immediately striking back occurs.

In order to prevent the ball from being thrown upwardly when striking back occurs and also to prevent loss of water if the tap at the point of consumption is opened suddenly, deflector plates 115 are provided which at the same time constitute an arrangement impeding flow.

Instead of employing a liquid, the container 121 could be filled with a gas which either has a flame extinguishing action or, if it is itself inflammable, produces a non-inflammable mixture with the mixture already present in the conduit.

Finally it is possible, as shown in Fig. 27, to provide a separate cylinder 116 filled with compressed gas, the closure member 117 of which is opened by the pressure wave by means of lever 120 through the intermediary of a cylinder 118 and piston 119 for example.

In the arrangements according to Figs. 25 and 27 a device for preventing the passage of oxygen should be incorporated between the device shown for preventing striking back and the source of supply. This further safety device may be in accordance with Fig. 4 or can be constructed in accordance with the principles of Figs. 13 to 20.

Moreover the devices according to Figs. 13 to 20 could be used separately for preventing the penetration of oxygen in conjunction with any desired devices for preventing striking back.

In the liquid filled safety devices as described in which the gas does not flow through the liquid during the normal operation, it is advantageous to utilise in place of water a liquid which is not volatile or which evaporates only with difficulty, e. g. glycerine. In view of the small dimensions the question of cost is of little importance in comparison with the reduced attention which is required.

The invention can be applied for all purposes in which there is the risk of an explosion, e. g. in autogenous welding, cutting and hardening plant, gas firing equipment plant producing lighting gas, oil and gas machines and so on.

A modification of the construction of Fig. 4 is shown in Fig. 28.

The working gas entering the space 132 through the gas supply pipe 131 lifts the valve plate 134 from the seating 136. The valve plate 134 is loaded by the weight 139 and constitutes the bottom of the bellows 133. The gas can thus gass through the opening 135 in the disc 134 into the space 137 and through the conduit 138 to the point of consumption.

When oxygen passes back the disc 134 closes.

When striking back occurs the valve plate 134 is urged downwardly very rapidly because the weight 139, the tension in the bellows and the pressure wave operate in the same sense. The valve thus not only prevents the passage of oxygen but also prevents striking back.

To protect the bellows against the high pressure arising when striking back occurs, a non-return valve 140 can be incorporated in the conduit 138. This valve may be connected rigidly or loosely with the plate 134 or it may be an independent valve. The valve 134 or the valve 140, or both may be provided with an arresting device.

Instead of employing a bellows, use can be made of an apertured flat diaphragm which may be subjected to preliminary tension.

The connection with the diaphragm valve controlled by the pressure difference can be effected through the conduits 33 and 30.

Fig. 29 shows a construction similar to that illustrated in Fig. 28 in which a special spring is used instead of the rubber which may be burnt. The perforated valve-cone 141 is fixed to a heavy spring plate 142, loaded by a weight 139, at the edge of which plate a toothed rim 143 is provided. During normal operation the spring plate 142 is not bent but on admission of gas by way of the supply pipe 131 the spring 133 is stretched only and the gas passes, by way of the opening in the valve-cone 141, into the discharge pipe 138. If oxygen flows back in the direction indicated by the arrow shown in dotted lines, the valve 141 is closed. If striking back occurs, however, the plate 142 is bent to such an extent that the tooth 144 of the holding device engages in the teeth of the toothed rim 143.

According to Fig. 30 a heavy spring is arranged between the plate 143 fixed to the valve rod 156 and the valve-cone 151 which spring firmly presses the pin 154, fixed in the valve-cone 151, against the lower surface of the slot 155 provided in the rod 156. During normal operation the valve-cone 151 and the bellows 152 form a unit. If striking back occurs, however, the spring 153 is compressed so that the tooth 144 of the holding device engages the teeth of the toothed rim 143. The transfer of the leading pressure into the coil 24 may be prevented by a valve 23. If necessary, this coil 24 may specially be formed as a retarding coil. Instead of the bellows 152 a flat disc diaphragm may be used which is protected by a refractory substance against the flame.

Due to the arrangement of the holding device, the constructions shown in Figs. 29 and 30 in no way prevent the free play of the valve during the normal operation.

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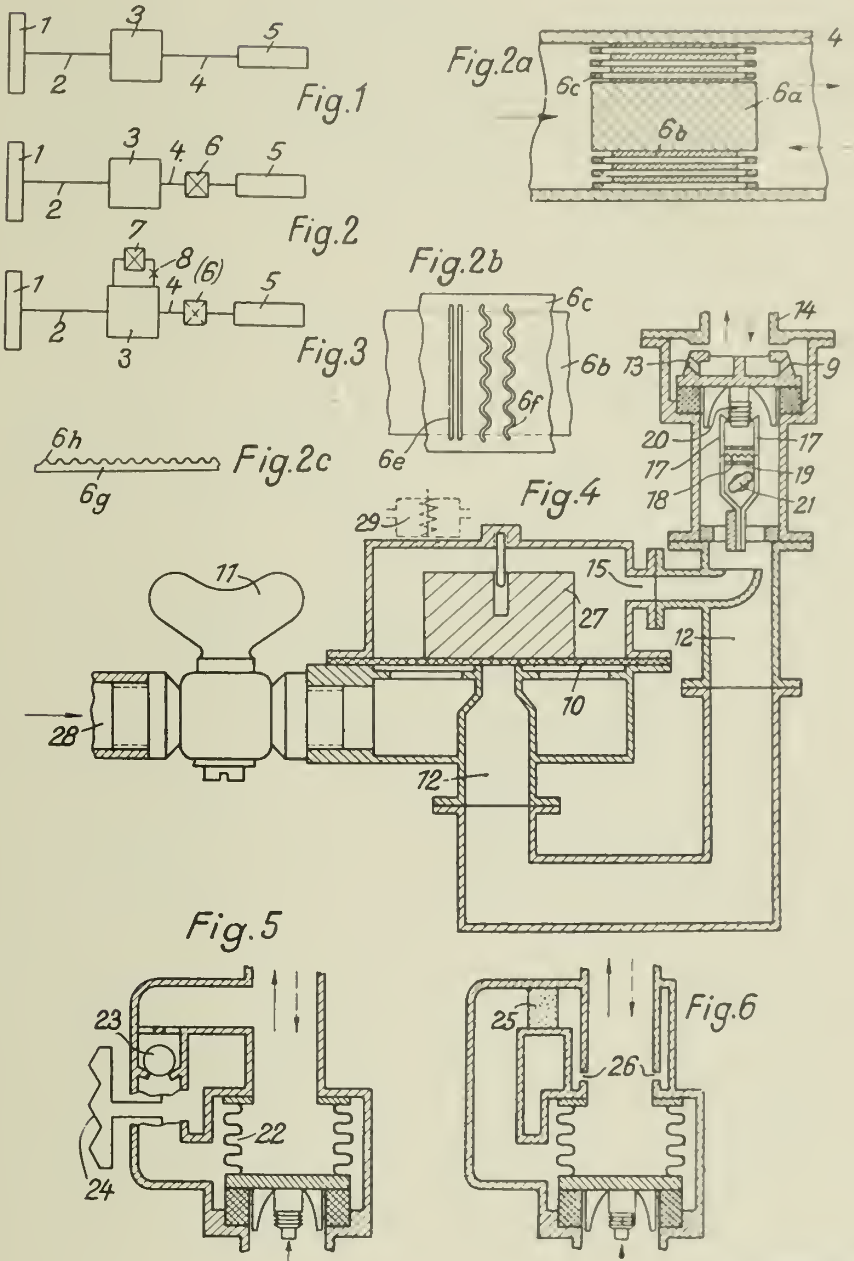
PUBLISHED
APRIL 27, 1943.
BY A. P. C.

E. WEESE
SAFETY DEVICES FOR GAS CONDUITS
Filed July 19, 1939

Serial No.
285,434
5 Sheets-Sheet 1



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SAFETY DEVICES FOR GAS CONDUITS
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Serial No.
285,434
5 Sheets-Sheet 2

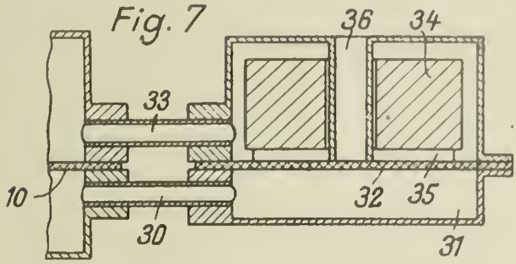
Fig. 7


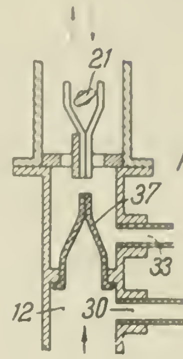
Fig. 8


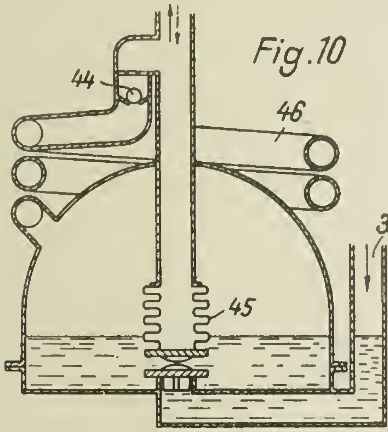
Fig. 10


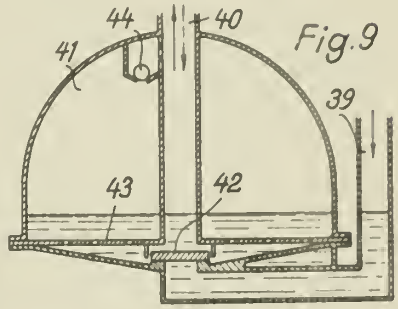
Fig. 9


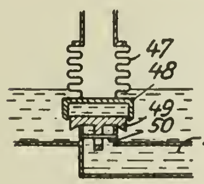
Fig. 11


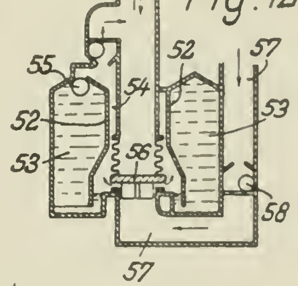
Fig. 12


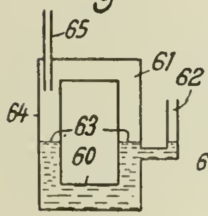
Fig. 13


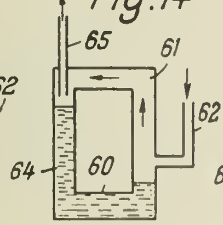
Fig. 14


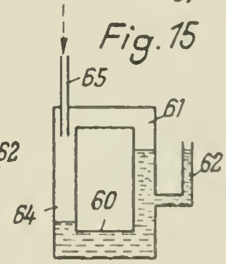
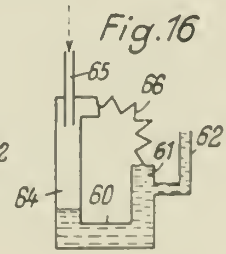
Fig. 15


Fig. 16


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PUBLISHED | E. WEESE | Serial No.
APRIL 27, 1943. | SAFETY DEVICES FOR GAS CONDUITS | 285,434
BY A. P. C. | Filed July 19, 1939 | 5 Sheets-Sheet 3

Fig. 17

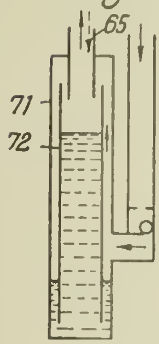


Fig. 18

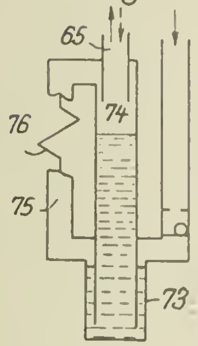


Fig. 19

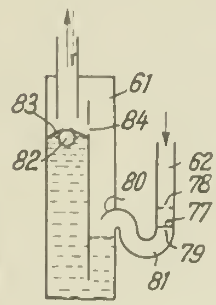


Fig. 20

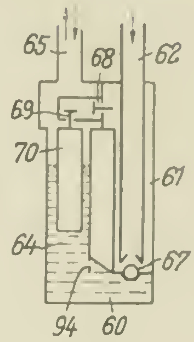


Fig. 21

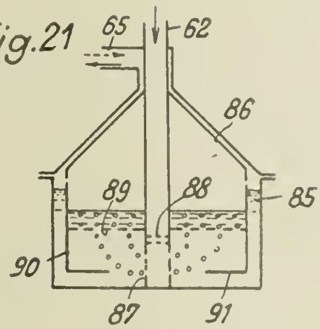


Fig. 22

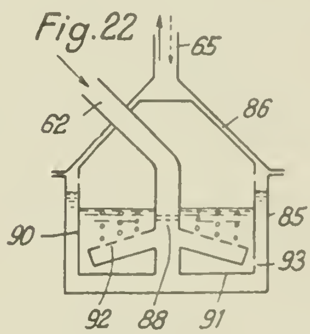


Fig. 23

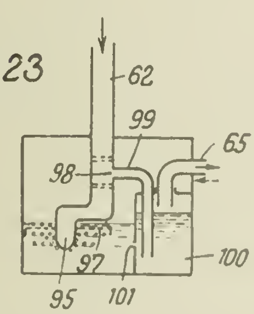
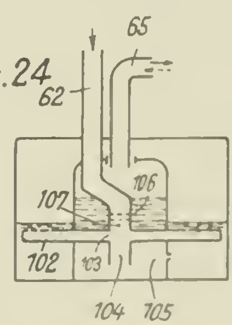


Fig. 24



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PUBLISHED
APRIL 27, 1943.
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SAFETY DEVICES FOR GAS CONDUITS
Filed July 19, 1939

Serial No.
285,434
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Fig.25

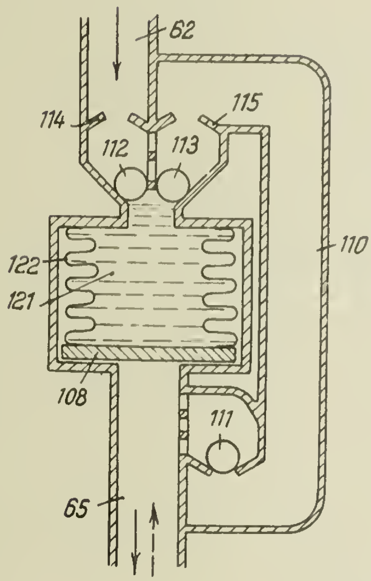


Fig.27

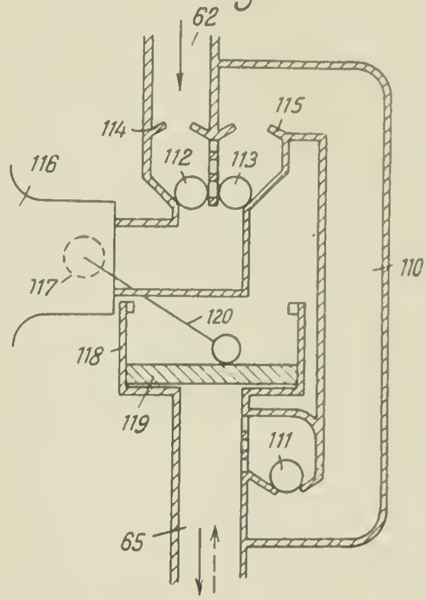


Fig.26

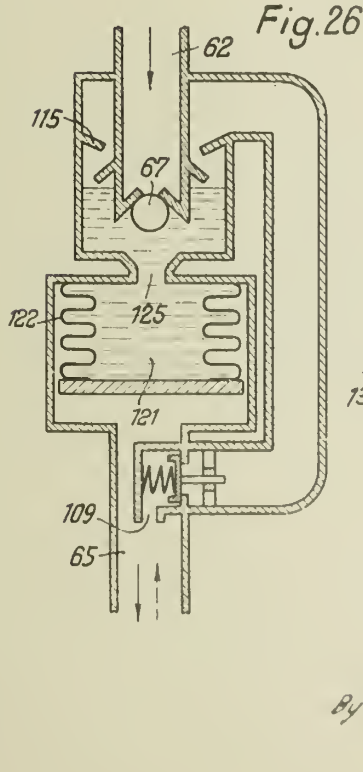
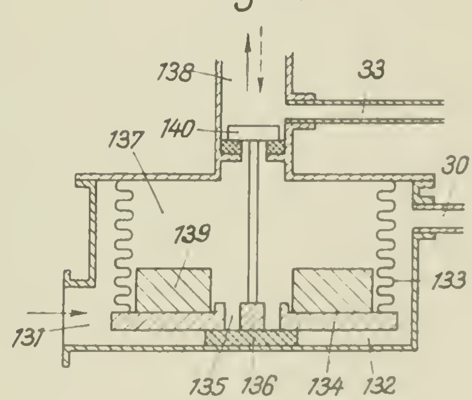


Fig. 28



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PUBLISHED
APRIL 27, 1943.
BY A. P. C.

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SAFETY DEVICES FOR GAS CONDUITS
Filed July 19, 1939

Serial No.
285,434
5 Sheets-Sheet 5

Fig. 29

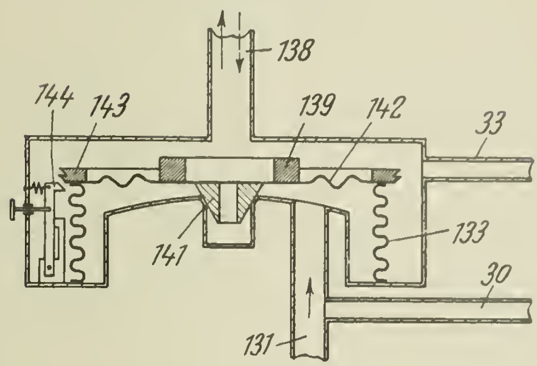
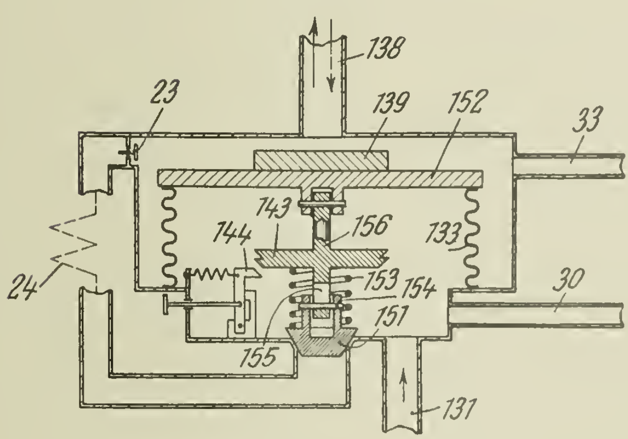


Fig. 30



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Attys.

Published Apr. 27, 1943

Serial No. 285,774

ALIEN PROPERTY CUSTODIAN

WOOL-LIKE ARTIFICIAL FILAMENTS

Günther Bugge, Neu-Isenburg, Germany; vested in the Alien Property Custodian

Application filed July 21, 1939

Numerous processes are known for curling artificially produced filaments formed of materials capable of being spun, such as cellulose solutions and the like, and thus converting them into a form in which they can be easily formed into a fleece and then into wool-like spinning threads. The chemical and/or physical means heretofore used for such curling make possible only relatively coarse, inaccurate and poorly controlled curling. In addition, threads so produced do not provide when woven a material even closely approximating in appearance or feel that produced from genuine wool fibres.

It is also old to use, instead of spinnerets, in the production of artificial silk, an arrangement consisting of a pair of rotating rollers the surfaces of which are provided with grooves semicircular in cross section and disposed perpendicularly to the roller axis. With such a device, by feeding an artificial silk spinning solution, filaments are produced which are merely similar to those extruded from a spinneret. On the other hand, it is also old to produce fabric imitations by means of engravings on rotating rollers which simulate fabric patterns. These procedures, however, have nothing to do with the production of curled artificial silk filaments with irregular surface forms, similar, for example, to natural wool. In one case, uncurled smooth filaments are produced; in the other, no filaments are produced, but only stamped or pressed film-like structures, intended to make the preliminary production of filaments unnecessary. Another old method, similar to the two above described, consists in providing the engraved portions of the pressing rolls from which thicker portions of the structure are to be produced with ribs. This method likewise is in no way analogous to the production of curled and superficially irregular spun filaments, but is based on the opposite purpose, that is, of avoiding the production of spun filaments entirely.

The primary object of the present invention is to produce artificial filaments having the feel and appearance of wool, and particularly when such filaments are woven into a cloth. The invention does not contemplate the production of the cloth directly, but only in the usual manner of forming threads and then weaving them.

A second object of the invention is to produce a curled artificial thread, and especially such a thread having irregularities therein so as more nearly to resemble a natural wool thread. More especially, the invention relates to the manufacture of a thread which has a natural or set curl, or in other words, one which is solidified in a curled state, as contrasted with a thread to which the curl is applied after it has been solidified.

A further object of the invention is to provide a simple and economical method and apparatus by which such threads may be produced directly from a solution of artificial silk or other material.

Further objects and advantages of this invention will be seen from the following description taken in conjunction with the accompanying drawings which form a part thereof.

In the drawings:

Fig. 1 shows in front elevation a machine embodying the invention;

Fig. 2 is a side view thereof;

Fig. 3 is a cross section on the line 3—3 of Fig. 2;

Fig. 4 is a detail view on a large scale of a portion of the surface of one of the rolls;

Fig. 5 is a cross section on the line 5—5 of Fig. 4;

Fig. 6 shows in front elevation a modified form of machine, for producing threads with cores;

Fig. 7 is a side view thereof; and

Fig. 8 is a view similar to Fig. 5 of a portion of one of the upper rolls of Fig. 6.

It has been discovered that curled artificial filaments with irregular surfaces can be produced if the artificial silk is shaped by a pair of rolls, these rolls being provided with parallel or approximately parallel grooves engraved therein perpendicular to the axis, these grooves being of undulating, zig-zag, or other suitable shape, and being preferably also provided with extensions, enlargements, bulges or the like. The filaments formed in these grooves may deviate or differ from the conventional smooth cylindrical form as much as desired. It is thus possible to produce surface structures of the filament which resemble the natural wool fibre with its squamous or scale-like appearance. For this purpose it is necessary only to give the groove the negative shape of a wool fibre.

The velocity of the rotating rolls and the concentration or composition of the spinning solution are so selected that the filaments formed during the filling of the grooves are more or less coagulated. This can be done according to the wet spinning method by applying to the rolls a coagulating liquid. In a dry spinning method any suitable procedure may be used. The engraving of the rolls, which are preferably of metal, for example, copper, can be carried out in the same manner as screen etching. Use can also be made of rolls of pressed synthetic material, on the plastic surfaces of which the desired filament

forms can be pressed by patterns of steel or the like, after which the rolls are hardened.

Figs. 1 to 5 of the drawings show one type of machine for carrying out the process according to the invention.

Mounted in a frame 2 are rollers 4, the surfaces of which are in contact with each other. These rollers rotate in the frame on shafts 6, and the rolls are connected to each other by gears 8 to turn together at the same speed in opposite directions. The rolls may be driven by a wheel 10 from any suitable source of power.

Mounted above the rolls is a reservoir 12 for the liquid which is to be formed into threads, which may, for example, be a solution of a cellulose derivative, such as cellulose acetate, or any other suitable organic material. The reservoir 12 has a downwardly extending feed member 14 arranged in the space between the rolls and close to the line of contact therebetween.

The rolls themselves are provided with suitable mating grooves for forming threads having a wool-like appearance. For example, the flat surface 16 may, as shown in Figs. 1 and 4, be provided with a plurality of grooves 18 which are of wavy shape, although any other irregular shape may be provided if desired. The term "undulating" is used to describe such irregular shapes, which lie outside of planes transverse to the roll axis. Preferably these grooves are substantially parallel, although exact parallelism is not in any sense requisite. The grooves are generally semicircular in cross section, as shown by the second groove in Fig. 5. However, these grooves are also provided with projections or recesses in order to give irregularity to the shape of the filaments, so that these will not be of purely circular cross section. These irregularities may comprise lateral projections or widenings of the grooves, as indicated at 20, or may consist of deepening of parts of the grooves, as indicated at 22.

Of course, the grooves on the two rolls are arranged exactly opposite each other, so far as their general outlines are concerned, although this is not requisite as far as the enlargements or recesses are concerned.

There is also provided below the rolls 4 a take-up roll 24 upon which the finished threads may be wound.

In a wet spinning process, a coagulating liquid is supplied to at least one of the rolls from a reservoir 26, from which the liquid flows through an outlet 28 to the surface of one of the rolls, preferably adjacent the top thereof.

The device above described operates in the following manner. The reservoir 12 is filled with a suitable solution, such as a solution of cellulose acetate. This solution flows out through the outlet 14 into the space between the rolls. As the rolls turn, the solution is forced into the grooves 18, while any excess is squeezed back upwardly by the flat surfaces 16 which are maintained in contact with one another. The lefthand roll brings with it a coagulating liquid from the reservoir 26, so that the filaments formed within the grooves 18 are immediately coagulated.

The coagulated filaments 23 leaving the rolls are wound on the take-up roll 24.

Since the filaments are coagulated while they are in the wavy portions of the grooves 18, they are inherently curled as they leave the rolls. In other words, the filaments are hardened or solidified while in a curled state so that they have a natural tendency to hold this curled shape. Furthermore, the cross section of the filaments is not regular and circular throughout, but is irregular because of the projections 20, 22, which form bumps on the filament surfaces. The filaments thus produced resemble natural wool fibres and are particularly similar to natural wool when woven into a cloth.

The filaments are thereafter dried, hardened or treated in any other conventional manner.

The modified form of the invention shown in Figs. 6 to 8 produces the additional effect of making the filaments even more irregular and of giving them a heat insulating effect. For this purpose, the reservoir 30 and nozzle 32 feed to the space between two rolls 34, which preferably have circular grooves 36 of regular semi-circular cross section, although undulating grooves may be used. The radius of the grooves 36 is somewhat less than that of the grooves 18. The filaments 40 formed between the rolls 34 are fed over guide rolls 38 to the space between the rolls 4. At this point, the small diameter filaments 40 are fed into the grooves 18 of the rolls 2, but, of course, do not fill these grooves. At the same time, reservoir 12 through nozzle 14 feeds additional solution into the space between the two rolls 2. This forms a second layer on the filaments 40 so as to produce a double-layer filament 42 which is wound on the take-up roll 24.

The outer coating, at least, of this filament is inherently curled, because of the undulating nature of the grooves 18. It is also of irregular cross section because of the projections 20, 22 of the grooves 18. At the same time, the coating layer will be of irregular thickness, or, in other words, will not be concentric with the core filament 40, since there is no positive guiding of the core filament to insure that it is held rigidly in the center of the grooves 18. Finally, a filament so formed has great heat insulating qualities since a layer of air is usually trapped between the core 40 and the outer covering, even though this air layer is quite thin.

The diameter of the grooves, and therefore of the filaments, is limited only by the skill of the engraver or etcher. However, as the filaments produced shrink during hardening and drying and are also stretched in the usual manner, the cross section of the grooves should be somewhat larger than the desired cross section of the finished filament.

The invention provides filaments which, by reason of their irregular surface formation which promotes mutual coherence, make it possible to produce a very good fleece, whether the filaments are cut in the staple or treated as endless filaments. The fabrics produced from such threads are thus characterized by resistance to creasing and by elasticity and have good heat-insulating properties. A special advantage of the invention lies in the possibility of obtaining an exact limitation of a natural wool thread, that is, to attain the desired degree of curling, as well as to produce the typical superficial structure of natural wool.

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PUBLISHED
APRIL 27, 1943.
BY A. P. C.

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WOOL-LIKE ARTIFICIAL FILAMENTS
Filed July 21, 1939

Serial No.
285,774
2 Sheets-Sheet 1

Fig. 1.

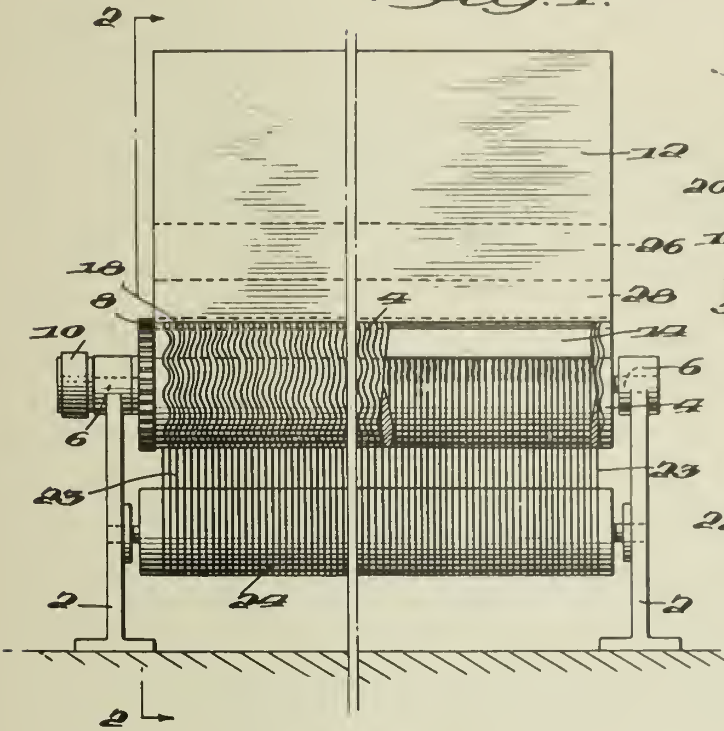


Fig. 4.

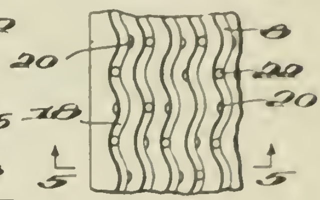


Fig. 5.

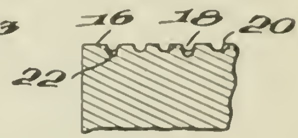


Fig. 2.

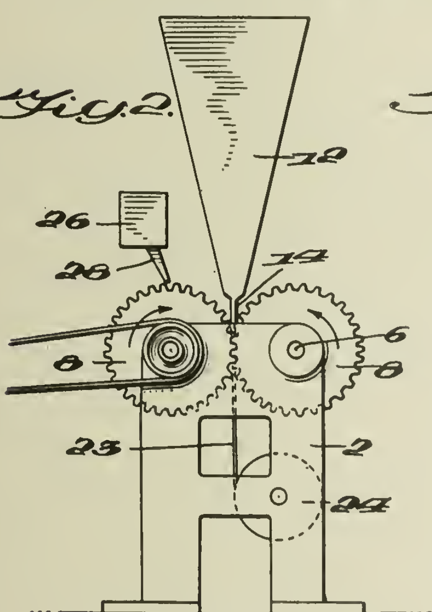
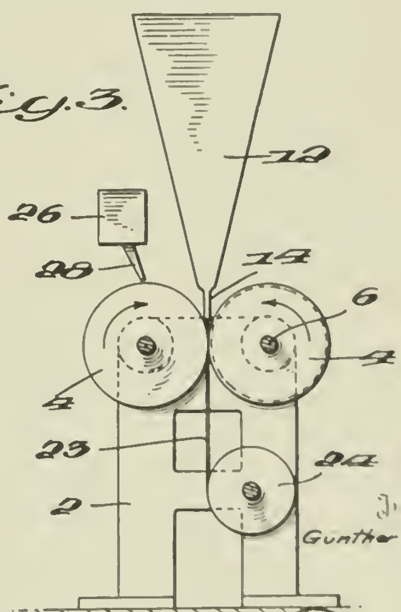


Fig. 3.



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PUBLISHED
APRIL 27, 1943.
BY A. P. C.

G. BUGGE
WOOL-LIKE ARTIFICIAL FILAMENTS
Filed July 21, 1939

Serial No.
285,774
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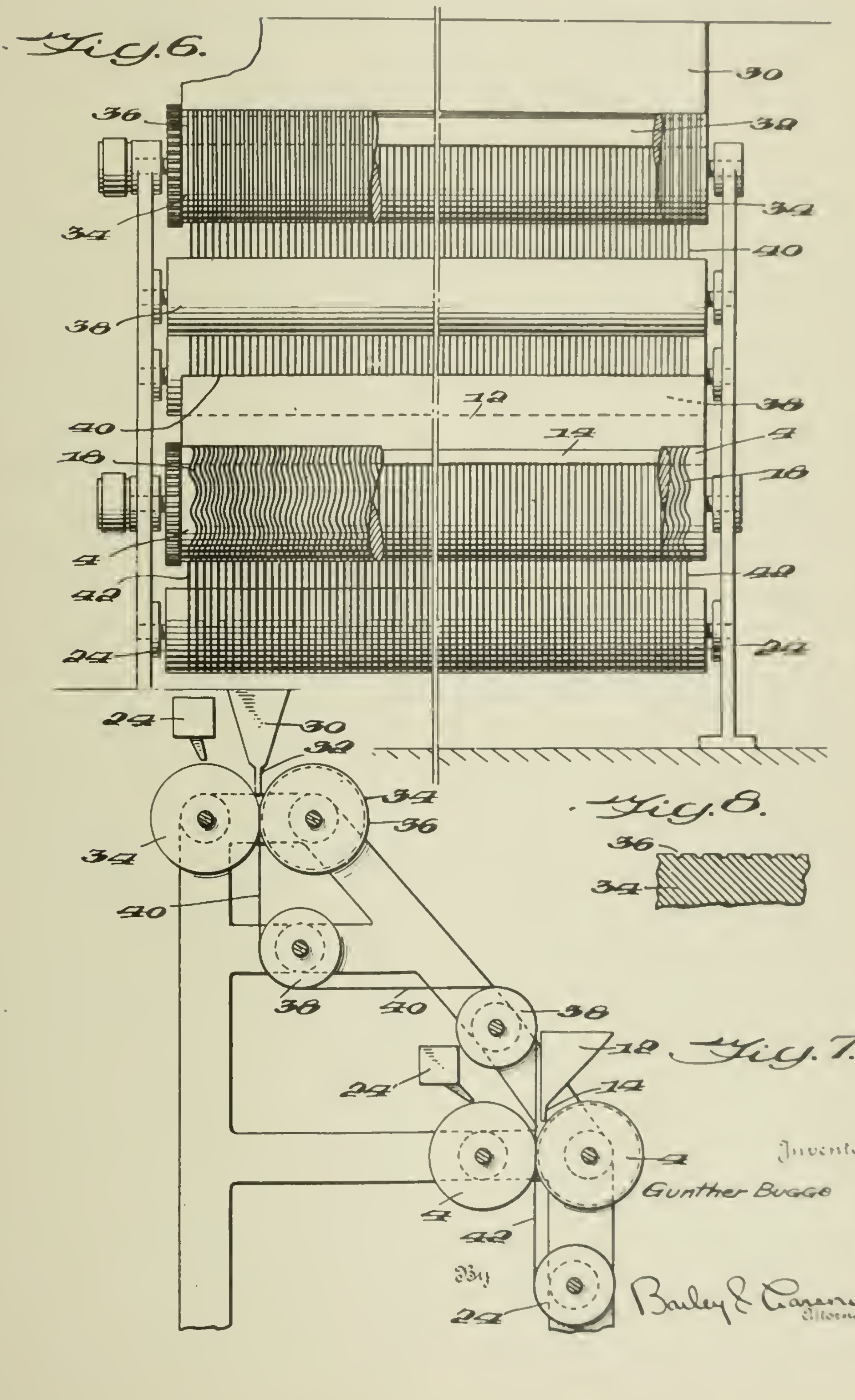

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Attorney

Published Apr. 27, 1943

Serial No. 285,944

ALIEN PROPERTY CUSTODIAN

METHOD AND MEANS FOR THE PRODUCTION OF ORNAMENTAL SCREENLIKE MATERIAL

Daniel Swarovski, Wattens, Tyrol, Germany; vested in the Alien Property Custodian

Application filed July 22, 1939

The invention relates to a method and a device for the production of tapes, chains or the like comprising plastic materials held together by mounting means, such as threads, wire webbing and in some cases with decorative objects, wherein the threads or the like are embedded in the material during the plastic formation thereof.

Tapes, chains etc. of the type set forth particularly when of a more flat shaped structure, are used as trimmings for dresses or for objects of use and the like, and may also, without any special strengthening, be employed for the production of objects such as satchels or the like.

An object of the invention is to provide a method and means for the mass production of tapes, chains or the like of the type set forth in a particularly simple and cheap manner, and above all to avoid all interruptions in manufacture, which may easily occur with the formation of the above-mentioned bodies on the supporting threads, nets or webs, and which may lead to some of the articles being rejected. The invention also covers means for ensuring the position of the mounting means during production, and means for the simplification of the production of the tapes, both as regards the process and the devices for practising the said process.

According to the invention, a process is provided for the production of tapes, chains or the like comprising plastic materials held together by mounting means, such as threads, wire, webbing and in some cases with decorative objects, the threads or the like being embedded in the material during the plastic formation thereof, whereby the mounting means is under tension during the moulding of the body, the tension being preferably the same for the threads or the like which extend parallel to one another. The mounting means on which the bodies are repeatedly formed advantageously moves step-by-step, upon the formation of the bodies, through the mould in which the said bodies are formed and the threads or the like, in the direction of movement of the tape, are held under a continuous tension.

The invention also provides a device for carrying out the process according to the invention, wherein at the sides of the mould serving for the group production of the bodies and opposite to the direction of the threads are arranged, on the one side, thread supply reels mounted on, for example, slides forced away from the mould by means of springs, and, on the other side, a take-up drum or the like for the tape provided with the bodies.

In order that the invention may be readily understood and practised, some embodiments thereof will now be described with reference to the accompanying drawings, in which:

Figures 1 and 2 illustrate diagrammatically two forms of construction of tapes or chain-like structures consisting in approximately semicircular bodies held together by parallel or crossed threads;

Figure 3 illustrates a diagrammatic side view of a device for practising the process;

Figure 4 illustrates a longitudinal section through the mould for forming the body;

Figure 5 is a top view of the lower part of the mould for the production of a tape with transverse threads as a mounting means of the main body.

Figure 6 illustrates an alternative device for the production of articles having transverse threads.

Referring to Figures 1 and 2, the bodies 1 possess in this embodiment approximately a hemispherical shape whereby the under-side has the configuration of a flat ball cap. The connections between the bodies consist in threads 2 which pass through the plane determined by the plane of the ball caps. In the tapes according to Figure 1, parallel threads are provided throughout, the threads pairwise carrying a series of bodies staggered relatively to one another. According to figure 2, longitudinal and transverse threads are provided, pairwise carrying a longitudinal or transverse series of bodies, whereby four threads extend through each body.

The moulding of the bodies and the simultaneous embedding of the threads in the plastic material may be effected by casting, spraying or in a press. The necessary mould is fixed on a bench 3 and consists in a lower part 4, an upper part 5 and a cover 6, in which the plastic mass is inserted and appropriately distributed. The lower part 4 of the mould (figure 4) contains the negative impression 7 for the upper raised ball heads, whilst the upper part contains the negative impression for the lower ball caps of the lower side of the body. In the lower part 4 are also grooves for the threads 2 which pass through a thread guide consisting in a bracket 8 firmly secured to the lower part 4. The cover 6 has correspondingly numerous openings 9 for pouring in the plastic mass which is distributed over the bodies forming a row, by way of passages 10, which are connected by openings 11 with the individual hollow moulds, through which the threads pass freely.

The threads, in parallel with each other, passing through the moulds, are held under the same tension, for which purpose the device illustrated in Figure 3 is employed. On the bench 3 are secured two columns 12, (one of which is invisible in Figure 3), each column comprising a stay bolt 13 having at one end an adjustable collar 14 which collar or abutment is held in position by means of a cotter pin. Jaws 15, 15′ are slidably arranged on the columns 12 and bolts 13 and are interconnected by means of a plate 16 which carries bolts 17, on which are placed the thread reels 18. Spiral springs 19 are arranged on the bolts 13, which press at one end against the front ends of the colmns 12 and at the other end against the outer jaws 15 and force the reels 13 away from the mould. The bolts 17 have conical bases 20 on which are seated the reels 18, and have at the top slidable cones 21, to brake the rotation of the reels, which extend into the bores of the reels and thus centre same. Above the cones 21 small helical springs 22 are arranged on the bolts 17 which may be kept in tension by the adjusting nuts 23, by means of which the cones are forced into the reel bores and the reels on to the conical bases 20. The pressure may be adjusted in such a manner that the threads can only be drawn off by overcoming the resistance of the reels to rotation, the threads being under tension in the end position of the slide illustrated. The take-up support for the threads under tension may be arranged for the finished tape itself with the bodies already anchored on the threads, and may consist of a winding drum. Such a drum 24 is arranged at the end of an arm 25, which is pivoted at 26 on the bench 3 and rests, due to its own weight, on a stop 27 on the bench. The drum carries a disc 28 for hand operation for pivoting the arm 25 and for turning the drum. Instead of the drum any other suitable apparatus for carrying the finished tapes may be employed.

The threads under tension lie uniformly in the hollow chambers of the mould so that the bodies may be formed on the threads at exactly equal distances apart. The bodies consist in warm plastic masses obtained by casting or spraying, and preferably of heatable plastic masses formed by presses or a compressed casting process. The bodies may also be produced from a sprayed metal. After removal of the mould parts 5 and 6 and the pouring members, the finished part of the tape is removed from the lower part of the mould 4 by displacing the arm 25 in a clockwise direction, and the tape is then wound on the drum by rotating it, whereby corresponding lengths of the threads are drawn from the coils 18. The moulding process may then be repeated.

In order to ensure that the next following group of bodies are spaced apart at correct distances, in the lower part 4 and upper part 5 of the mold, at the outlet side of the tape, a transverse row of hollow moulds 29 is arranged which are, however, not connected to the material distribution passage 10. In these hollow moulds the last transverse row of the finished bodies next to those to be formed is laid (Figure 4). The above-mentioned last series of bodies also anchors the threads to be provided with bodies against the pull of the reel slide.

For the production of tapes, according to Figure 2, with transverse threads, tension devices are also provided for the said transverse threads. In the step-by-step production of a long tape the transverse threads are cut off after each moulding prior to the advance of the tape, the ends of the threads separated from the finished tape being inserted in the mould for the next series of bodies. Such an action can be effected by means of a suitable clamping device. Since, however, the process deals with plastic masses, the process may also be practised as illustrated in Figures 5 and 6.

The mould, the lower part of which is illustrated in Figure 5, has the hollow shapes for the bodies to be moulded and a transverse row, not used for casting, in which may be inserted the last transverse row 30 of the previously finished tape. The threads 2 pass through their thread guide 8 in longitudinal direction, and the threads 2′ pass through their thread guide 8′ in the transverse direction. Tension is maintained on the longitudinal threads in the manner described above, the tension on the transverse threads, which are also subjected to a tension from the reels, may be provided by means of a clamping device which during the step-by-step production may work in the following manner. The mould possesses, in addition to the hollow moulds for the bodies, two longitudinally extended hollow spaces 31 on the running side of the transverse threads through which pass the said transverse threads. At the same time the bodies are moulded or immediately following this operation, bridge pieces are formed in the hollow spaces which connect the cross threads with one another in their correct relative positions. On removal of the upper part of the mould and cover, the cross threads are cut off by inserting a knife in the slot 32 of the lower part 4, the opposite side being also cut off, whereupon the further movement of the finished part of the tape and the longitudinal threads can occur in the above-described manner. The bridge pieces seated in the hollow spaces 31 of the lower part 4 are then removed, for example, by grasping the cross threads handing thereto, within the thread guide 8′ by means of a comb-like tool and laying them on the opposite side and attaching them behind the stops 33 of the lower part, in which position they are indicated by reference numeral 31′. After the following moulding process the cross threads are preferably cut off between the stops and bridge piece. The cross threads, during moulding, remain under constant tension. The bridging material may be used again.

An alteration to the above-mentioned process may be provided for the gathering of the ends of the transverse threads in a particular manner for the further movement of the threads, in which the transverse threads 2′ pass over the lower part 34 (figure 6) into the hollow spaces 35 where small knots are formed, which in this case serve only to anchor the threads in the mould. After moulding these knots, the parts of the transverse threads cut off at 32 are moved with the auxiliary mould into the new position on the opposite side by laying the auxiliary mould on the lower part 4 of the main mould, the lower part 34 of the auxiliary mould having handles 36. In the new position shown in the lower part of figure 6, the upper part 34′ having passages for the distribution of the plastic material with pins 37 and injection openings 38 are visible. The knots may be replaced by small bridge pieces which need not be connected together, as the spacing of the transverse threads is ensured by the auxiliary mould. For the separation of the transverse

threads at the holding device a groove **32'** is provided. For such a process two auxiliary moulds are required.

The device for tensioning the threads may also be arranged in a different manner. Instead of braking the reels, the threads themselves may be braked, for example, between the reels and the thread guide, appropriate brake rollers or similar devices may be provided through which the threads are arranged to pass. The reels may also be arranged differently, for example, one above the other.

The decorative tapes produced according to the invention may be treated by painting the formed bodies, or by spraying colour or lacquer thereon, as well as by drawing through coloured threads between the other threads or web parts.

DANIEL SWAROVSKI.

PUBLISHED

APRIL 27, 1943.

BY A. P. C.

D. SWAROVSKI

METHOD AND MEANS FOR THE PRODUCTION
OF ORNAMENTAL SCREENLIKE MATERIAL

Filed July 22, 1939

Serial No.
285,944

2 Sheets-Sheet 1

Fig. 1

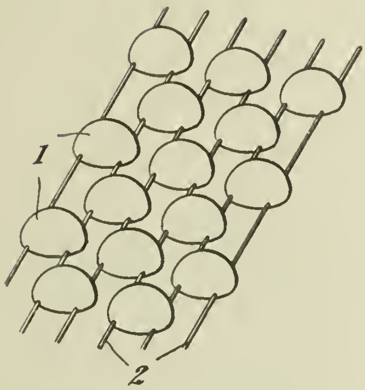


Fig. 2

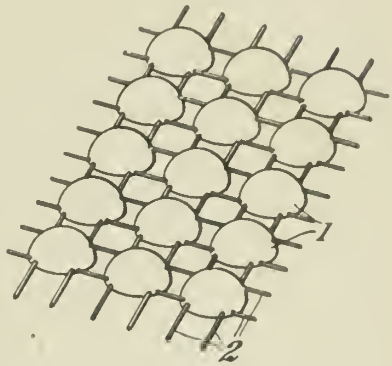


Fig. 3

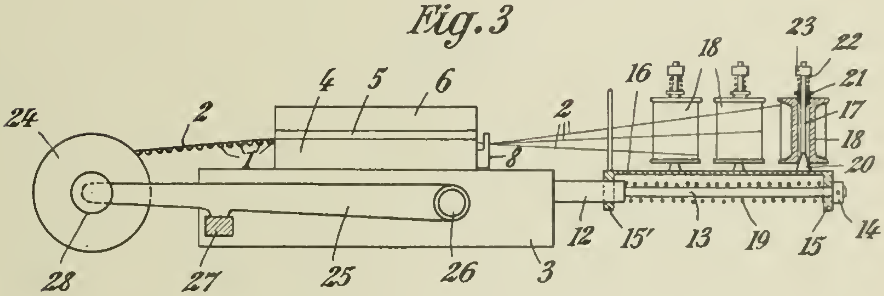
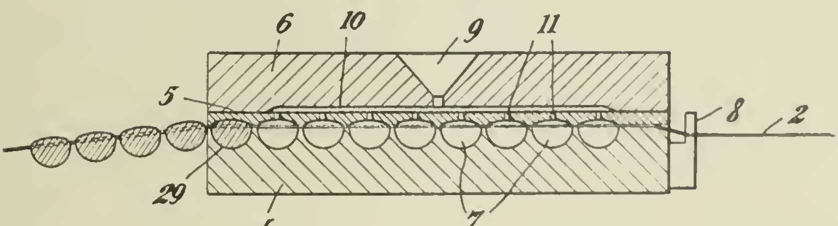


Fig. 4



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PUBLISHED

APRIL 27, 1943.

BY A. P. C.

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METHOD AND MEANS FOR THE PRODUCTION
OF ORNAMENTAL SCREENLIKE MATERIAL
Filed July 22, 1939

Serial No.
285,944

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Fig. 5

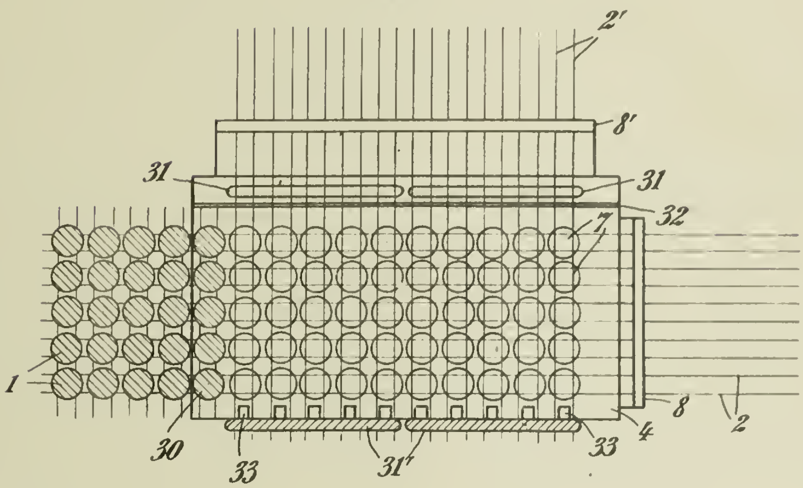
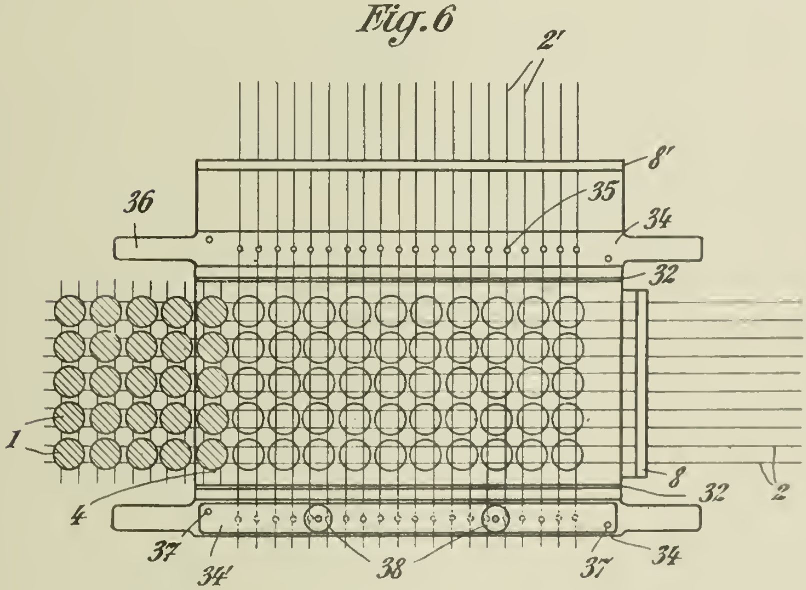


Fig. 6



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ATTORNEY

Published Apr. 27, 1943

Serial No. 286,038

ALIEN PROPERTY CUSTODIAN

METHOD OF AND APPARATUS FOR KNEADING AND MIXING RUBBER

Karl Frei, Oberesslingen, Germany; vested in the Alien Property Custodian

Application filed July 22, 1939

This invention relates to a method of and apparatus for kneading and mixing rubber and other plastic materials of a like or similar nature.

Generally speaking, two different types of machines are known for this purpose, namely, mixing rolls on the one hand and kneading and mixing machines on the other hand, both types being available in single or double spindle design.

In the case of mixing rolls the actual mixing process is confined solely to that point at which the two rolls approach nearest to one another and impart to the rubber substance a characteristic pushing and masticating motion. The use of mixing rolls is a comparatively tedious and lengthy operation, for which reason in many instances kneading and mixing machines are found to be preferable.

The double-spindle kneading and mixing machines have two mixing rolls, which are mounted to be parallel to one another and are each rotatable in a depression of semi-cylindrical cross-section in the bottom of a trough. The mixing rolls themselves consist of rotatable cylindrical bosses extending through the trough longitudinally and having thereon one or more wings, ribs or blades of equal or unequal pitch. The mixing rolls are usually rotated in opposite directions. The actual mixing and kneading process carried out on the material situated in the space between the rolls, the blades and the side of the trough is always effected in such a way that the material is carried by the mixing rolls to a point above a so-called saddle and by the opposite rotation of the rolls is there kneaded together. This method of kneading and mixing requires a comparatively long time and necessitates extremely heavy and expensive machines.

As already stated, single-spindle machines for kneading and mixing rubber are also known. In these machines a longitudinally disposed shaft furnished with mixing blades and rotatable about its own axis operates in a hollow cylindrical container. The mixing blades are arranged diametrically opposite to one another on their common shaft, usually in helical disposal according to a certain pitch. Owing to the provision of the blades on a common shaft and the uniform speed and direction of rotation of the blades thus brought about there is always considerable danger of the rubber or like material being rolled or balled together. It is for this reason that machines of this character for the treatment of rubber or like substances have not acquired any significance in practice.

It is the object of the invention to devise a new process for kneading and mixing rubber and like materials, and to provide a kneading and mixing machine which is particularly adapted for carrying out such process.

A further object of the invention is to eliminate the disadvantages attendant on the previously known methods of kneading and mixing rubber and like materials and on the machines employed for this purpose, and to provide a new method and apparatus by which the kneading and mixing operation can be carried out much more effectively, rapidly and cheaply than heretofore.

Whereas in the known machines the kneading and mixing operation has been carried out in practice in the space between two elements disposed parallel to one another, the kneading and mixing operation according to the invention takes place in a working space which is not parallel to the longitudinal axis or axis of rotation of the kneading and mixing elements, but is disposed transversely thereto.

According to the invention, the material to be kneaded and mixed is forced axially always in the one direction, i. e., towards the interior of the trough, in positive fashion into the transversely disposed working space, where it is subjected to a treading, squeezing and drawing action between the relatively rotating kneading and mixing elements, and thus to a very peculiar but nevertheless extremely rapid and efficient kneading and mixing process.

The invention is illustrated by way of example in the accompanying drawings, in which

Fig. 1 is a section through the improved machine according to the invention taken on the line I—I in Fig. 2.

Fig. 2 is a cross-section on the line II—II in Fig. 1.

Fig. 3 is a sectional view of an embodiment, in which one of the two mixing elements situated axially opposite to one another is arranged to be stationary.

Fig. 4 is a cross-section taken on the line IV—IV in Fig. 3, viewed in the direction of the arrows.

Fig. 5 is a perspective view of a preferred embodiment of kneading and mixing element.

With reference to the drawing, two kneading and mixing tools are arranged in a kneading and mixing trough 1, which can be closed on all sides or may also be partially open, not as heretofore in parallel disposal side by side, but axially opposite to one another. In Fig. 1 both kneading and mixing elements are rotatable independently of one another. The design of the kneading and

mixing elements intended for a machine according to Figs. 1 and 2 is disclosed in a preferred embodiment in Fig. 5.

The kneading blades or wings 2 of these elements are each mounted on a boss 4, which is conveniently tapered in the direction towards the working space 3 and is preferably of conical form, the blades or wings having a certain angle of pitch with respect to the axis of rotation of the boss, so that the material being treated is always forced towards the interior of the trough into the working space 3 formed between the two elements transversely to their axis of rotation. The direction of rotation of the kneading and mixing elements may either be equal or opposite dependent on the disposal of their wings or blades. If their direction of rotation is the same, the speeds of rotation must be different. If they rotate in opposite directions, their speed of rotation can be selected as desired, and if necessary they can be allowed to rotate at equal speeds. It is also possible under the invention to arrange for one of the two mixing and kneading elements to be stationary, in which connection reference is made by way of example to the embodiment illustrated in Fig. 3.

In this case only the element shown on the left is arranged for rotation, whilst the co-operating element is mounted rigidly in the machine or its trough. In the embodiment according to Fig. 3 the stationary element is designated 5 and comprises in substance a disc, which on its end face directed towards the rotary element is furnished with recesses 6, so that between the latter ribs or projections 7 acting as blades are formed, which serve to guide the material under treatment towards the working space 3 in substantially the same fashion as the blades of a kneading and mixing element (which if desired may also be stationary) in the embodiment according to Fig. 1.

The blades, wings or ribs can be provided in any desired number and with any desired pitch. In the case of kneading and mixing elements having a plurality of wings all of the wings, blades or ribs may have the same pitch or may differ in pitch. Further, the wings in the case of kneading and mixing elements having a plurality of wings may have the same radial dimensions or different radial dimensions. Moreover, a relatively slowly rotating kneading and mixing element may have a larger number of wings, blades or ribs than a co-operating, rapidly rotating kneading and mixing element. Similarly, the pitch angles of the wings of a comparatively slowly rotating kneading and mixing element may be larger than those of a co-operating rapidly rotating element.

The size of the operating space 3 between the oppositely disposed kneading and mixing elements will depend substantially on the nature of the material being mixed and kneaded.

It is not essential that the working space between all end edges 8 of the wings or blades of both elements be of the same extent. The blades or wings may also be of different size longitudinally to the axis of rotation and may also have different forms. The arrangement may also be such that the width of gap between the end edges 8 or 7 of the wings or blades rotating one past the other varies regularly or irregularly. It is advisable to round off the end edges of the blades—as clearly indicated at 9 in Fig. 5—so that they will at no time exercise a cutting or direct shearing action on the material in the operating space 3 but, on the contrary, assist in forcing the material to be kneaded into the working space and subjecting it to friction.

The trough and, if desired, also the kneading and mixing elements can be furnished with suitable cooling means. The provision of such cooling means is considered to be a practical measure not calling for particular illustration or description. The feeding and discharging of the machine can also be effected in any desired manner.

The operation of the machine is as follows: The material to be kneaded and mixed is introduced through an opening 10, which will usually be situated at the top of the trough, and is thus immediately subjected to the action of the kneading and mixing elements. The kneading and mixing elements either rotating in the same direction at different speeds or in different directions at the same or different speeds draw the material definitely into the trough by means of the oblique blades, ribs or wings and force it axially into the working space 3. In the working space 3 a rapid and highly effective kneading and mixing action takes place, the end edges 8 of the elements rotating past one another acting on the material with a frictional, squeezing, treading and pulling effect and also with a tendency to press the material together. The speed of rotation of the elements in relation to one another, the pitch of the blades or wings, the width of the working space, and the cohesive, adhesive and friction capacity of the material being kneaded are naturally factors which must also be taken into account in the specific design of the machine, but these do not alter the fundamental idea of the invention which, as it will be appreciated, resides in the kneading and mixing of the material in a working space situated transversely to the axis of rotation of the kneading and mixing elements.

The saddle effect on the material under treatment hitherto occurring in the machines having kneading and mixing elements disposed parallel to one another and taking place only once upon each revolution occurs in the machine according to the invention in a multiplied form dependent on the number of blades or wings provided.

The open character of the kneading and mixing elements in the direction towards the working space results in the interior of the trough, longitudinally thereof, in a multiplicity of hollow spaces in which the material can be taken up in comparatively large quantities, to be forced axially towards the centre, or in other words towards the transverse working space. As there are no shafts passing longitudinally through the trough as supports for the kneading wings or blades, the latter each being arranged independently on a boss, and these bosses being arranged axially opposite to one another to leave a certain intermediate space and preferably being of conical form, the new machine possesses a considerably greater capacity than the known kneading and mixing machines having a trough of the same size.

KARL FREI.

PUBLISHED K. FREI Serial No.

APRIL 27, 1943. APPARATUS FOR KNEADING AND MIXING RUBBER 286,038

BY A. P. C. Filed July 22, 1939

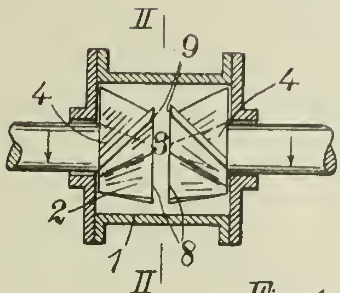

Fig. 1

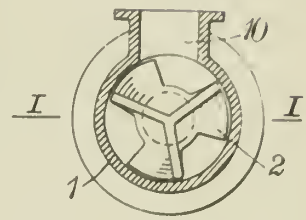

Fig. 2

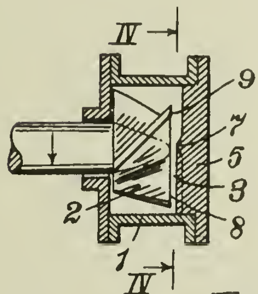

Fig. 3

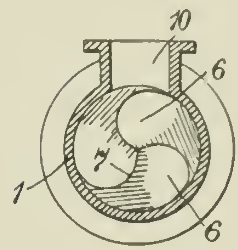

Fig. 4

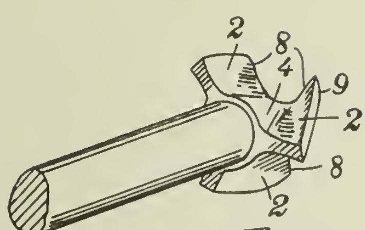

Fig. 5

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Published Apr. 27, 1943

Serial No. 286,126

ALIEN PROPERTY CUSTODIAN

MANUFACTURE OF ARTIFICIAL TOOTH

Paul Jean Jacques Gonon and Rene Francois Adrien Lakermance, Paris, France; vested in the Alien Property Custodian

Application filed July 24, 1939

The invention relates to artificial teeth of porcelain and more particularly to teeth intended to be fixed to their supports by sealing. To ensure a better securing of the seal, which is disadvantageously affected by the surface glazing on the porcelain after firing, it is possible to treat the sealing surface of the tooth with hydrofluoric acid. This treatment, however, does not do more than simply remove the polish from the surface of the tooth, and it is insufficient in many cases to ensure a strong enough sealing to obviate the loosening or accidental wrenching away of the tooth.

The subject-matter of the invention is a method which makes it possible to improve very considerably the securing of artificial teeth, and it relates moreover in the guise of novel industrial products to the raw material suitable for manufacturing particular artificial teeth, as also to teeth manufactured by the application of the method in question and of the material mentioned.

The method according to the invention consists in essence in incorporating in the porcelain, at the part of the tooth corresponding to the seal, powder of a variety of alumina exhibiting a hardness at least as high as that of the porcelain and a resistance to the attack by hydrofluoric acid substantially higher than that of porcelain, for example natural or artificial fused alumina powder. There is thus obtained after firing a product of which the surface exhibits in the part to which the alumina has been added a rugosity in proportion to the dimensions of the grains of alumina utilised, whence there results a considerably increased capability of retention by sealing.

It appears in addition that the incorporation of alumina in the porcelain not merely does not diminish the mechanical resistance of the latter but even ensures an increase of this resistance. In any case an excellent bonding of the alumina grains with the porcelain is observed, which can probably be explained by the fact that the alumina is attacked superficially in heat by the silicates entering into the composition of the porcelain.

In practice the alumina powder to be utilised for putting the invention into effect may be grains of corundum passing through sieves from No. 43 (corresponding to a grain size from 400 to 1410μ) to No. 220 (corresponding to a grain size from 25 to 90μ). The best results seem to be obtained by means of sieves between Nos. 80 and 150, the optimum dimensions for these grains appearing to be between 100 and 200μ. Nevertheless the grains corresponding to No. 220 still give an appreciable rigosity which is very much higher than that obtained by attacking an ordinary porcelain with hydrofluoric acid. The proportion of alumina incorporated in the porcelain may vary between wide limits. Satisfactory results are obtained for example by employing mixtures of porcelain and alumina corresponding approximately to a volumetric ratio of 2 for the porcelain and 1 for the alumina, the optimum ratio being determined by tests for each porcelain.

It is possible if desired to increase the rugosity obtained by the incorporation of alumina powder, and consequently the capability of retention by seal, by treating the surface in question cold with hydrofluoric acid. The latter attacks the porcelain but leaves intact the grains of alumina, of which the sharp edges are then fully exposed. It has been found that even the acid fluoride of ammonium, of which the attacking power on the silicates of the porcelain is greater than that of hydrofluoric acid, has practically no attacking effect on the grains of corundum incorporated in the porcelain in accordance with the invention.

The method constituting the subject-matter of the invention can be applied in all cases in which it is a question of fixing by sealing artificial teeth or portions of artificial teeth and particularly to reconstitutions in porcelain having to be sealed to natural teeth (crowns, inlays, onlays); also to artificial teeth of all kinds requiring to be sealed on metallic mountings or utilised on prostheses of plastic materials (vulcanite, celluloid synthetic resins and the like).

In the application of this method to porcelain crowns and inlays made by the dentist himself, it may be sufficient to line the platinum mould, upon which the porcelain is subsequently fired, with a thin layer of porcelain to which alumina powder is added. The firing of this layer is then proceeded with and the work is concluded by the methods usual with ordinary porcelain. After turning out of the mould the surface fired in contact with the platinum is glossy, but all that is necessary is to treat it cold with hydrofluoric acid to expose the grains of alumina and to ensure the rugosity favourable for sealing.

In the application of the invention to artificial teeth manufactured industrially several methods may be considered.

In one method during the moulding of the tooth a powder suitable for the production of porcelain and having alumina powder added to it is used for lining the parts of the mould corre-

sponding to the surfaces which must be rough on the finished tooth, the filling of the remainder of the mould being carried out with ordinary porcelain. The treatment by hydrofluoric acid may be carried out either by the manufacturer or by the dentist himself.

According to a second method, more particularly applicable to the teeth referred to as "diatoric", it is possible after drying the tooth and turning it out of the mould, but before firing, to use a brush for painting the surfaces to be made rough with a clear milk of porcelain having alumina powder added to it, after which firing is proceeded with.

A modification of this method may consist in painting with paste or varnish, to which porcelain may be added if desired, the parts of the raw tooth to be made rough, then in dusting them with alumina, the grains of alumina then becoming bonded to the surface as soon as the porcelain is vitrified in firing.

The invention can also be applied to diatoric teeth already fired by painting the desired parts of the tooth with a milk of porcelain having alumina added to it and having a fusing point slightly lower than that of the porcelain of the tooth, the tooth being then subjected to a second firing at a temperature high enough to fuse the porcelain painted on, but not sufficient to cause the fusion of the tooth itself.

The invention also comprises a starting material suitable for manufacturing artificial teeth of the type considered, this material being formed of a mixture of a powder of the composition commonly used for the manufacture of such artificial teeth, such as powder obtained by grinding porcelain previously fired, and alumina powder having the grain size and the characteristics defined above.

In every case the application of the invention makes it possible to obtain a quite remarkable strength of seal for the teeth. Thus it has been found that flat teeth, even without their usual pins, are effectively retained by the vulcanite, from which they appear to be inseparable. Such a result makes it possible to consider the manufacture of teeth of this type without pins, in which case the flat surface of the tooth may if desired be increased in area by grooves which can easily be provided in the moulding. In addition to a considerable simplification in the operations of manufacture and fitting of artificial teeth, the further result is obtained that the space occupied by the assembly members is reduced almost to zero. The possibility is also provided of reducing to a minimum the thickness of both of the porcelain and of the mounting of plastic material, which ensures in the end a considerable reduction in the cost and weight of the articles.

Another advantageous result secured by the invention is that the shrinkage of the plastic material (and in particular of the vulcanite) is practically no longer produced at the level of the roughened porcelain, the plastic material remaining closely bonded thereto. For diatoric teeth in particular, where this shrinkage though hardly apparent on the outside is nevertheless considerable and gives rise to voids into which substances capable of putrefaction may enter and be retained, the progress achieved is considerable from the hygienic point of view.

In addition, in the manufacture of this latter kind of tooth the firmness of the seal obtained by means of the invention is likely to make superfluous the retouching work usually carried out on these teeth after they are turned out of the mould and before firing for the purpose of making the central hole retentive. Independently of the simplification and the economy resulting from this suppression, diatoric teeth become interchangeable due to this fact, particularly in the case where the incorporation of alumina has been made during the moulding of the tooth, which makes it possible to use them by sealing on to metallic prostheses or bridges.

The accompanying drawing shows by way of non-limiting examples two methods of applying the invention.

Figure 1 is a sectional view of a flat tooth *a* fixed without pins to a prosthesis *b*, for instance of vulcanite. In accordance with the invention the sealing surface of the tooth *a* comprises a layer *c* of porcelain to which alumina powder is added. This surface is here provided with ridges *d* formed in the moulding for the purpose of increasing the strength of the seal.

Figure 2 is a sectional view of a diatoric tooth *e* sealed to a prosthesis *f* likewise of vulcanite. A layer of aluminated porcelain *g* is here provided over the whole surface of the tooth intended to be embedded in the mass of vulcanite. Due to the close bond between this latter and the aluminated porcelain no void is produced between the tooth and the prosthesis in consequence of the shrinkage of the vulcanite. As has been explained above the lateral hollows *i* (shown in chain-dotted line) which are usually provided before firing in the central hole *h* of the tooth for making it retentive may advantageously be omitted.

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PUBLISHED
APRIL 27, 1943.
BY A. P. C.

P. J. J. GONON ET AL
MANUFACTURE OF ARTIFICIAL TOOTH
Filed July 24, 1939

Serial No.
286,126

Fig. 1

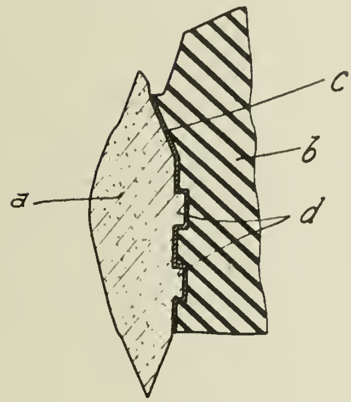
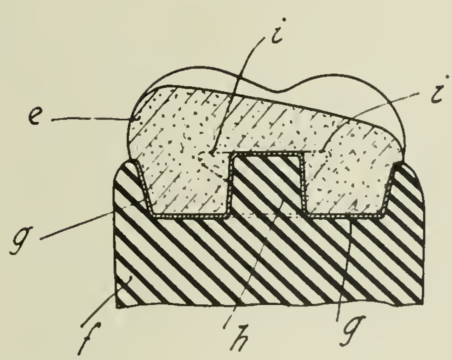


Fig. 2



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Published Apr. 27, 1943

Serial No. 287,002

ALIEN PROPERTY CUSTODIAN

HOLLOW RUBBER TOYS OF BIG SIZE AND PROCESS FOR THEIR PRODUCTION

Rudolph Fraknói, Matyasfold, Hungary; vested in the Alien Property Custodian

No Drawing. Application filed July 28, 1939

The manufacture of hollow moulded bodies, such as f. i. squeaking rubber toys, has hitherto been performed in two process phases which took place successively but practically independently from each other. In the first phase of the process, the hollow moulded raw rubber bodies have been partly or completely formed after stamping out and uniting of rubber sheets or portions thereof within suitable moulds, f. i. in moulds adapted to be used for the simultaneous stamping out of the sheets, whereas in the second phase of the process vulcanisation of the rubber bodies followed, generally coupled with simultaneous definite shaping.

For forming the hollow moulded raw rubber bodies numerous mechanical, physical and chemical processes are known the essence of which lies in that by means of an inner pressure obtained by the application of vacuum, compressed air or gas generating substances, the so-called inflating agents, the raw rubber body gets inflated and extended to a certain degree. The raw hollow body obtained in this way has thereupon been removed from the "forming"-mould f. i. from the mould adapted also for the simultaneous stamping and transferred into the vulcanizing mould in which the hollow rubber body was pressed under application of heat onto the wall of the mould and vulcanized in that condition.

This former process has drawbacks from economic as well as from technical points of view. Thus f. i. the process became more expensive and its economic exploitation was handicapped by the fact that special forming moulds and separate vulcanizing moulds were necessary, and by that the transference of the raw rubber hollow moulded bodies from one mould into the other had to be carried out in a special working operation demanding greatest care and attention.

In spite of the speediness by which the transference of the raw body from one mould to the other has been carried out, it could not be avoided that meanwhile, due to the properties of the raw rubber, the semi-product should collapse to a certain extent, whereby wrinkles and other irregularities have been caused. These irregularities were made definite by the vulcanisation so that inspite of the expensive and troublesome process only more or less defective products could be made.

In order to eliminate these drawbacks it has already been recognised that it is advisable to effect the forming of the raw hollow body and its subsequent vulcanisation in one and the same mould and it has already been suggested to this end to use a "forming"-mould preferably provided with stamping edges, which is at the same time the vulcanising mould. (These moulds are hereafter called "universal"-moulds.) The characteristic feature of the hollow rubber bodies produced by means of this process consists in that their stamp-welded seams are coinciding with the vulcanisation ridges formed during vulcanisation along the circumferencial closure-line of the normal bipartite universal mould, whereas in connection with earlier processes these seams did not coincide at all or have at least suffered a rather substantial dislocation, owing to the use of two different moulds.

However, the problem of making uniform hollow bodies did not come to a point of rest even after this substantial improvement. It has been stated that the methods for inflating and extending the raw rubber bodies found equivalent in the earlier processes were not equivalent when using universal moulds, i. e. in case that the process was transformed into a continuous one. It has shown in this connection that mechanical means are in any case more favourable than the chemical ones. In the method of employing inflating agents it is necessary to use high temperature in order to generate the gases required and it is obviously not an easy matter to regulate thereby the uniformity of the gas formation. Meanwhile the raw rubber softens to a considerable extent and due to the flowing tendency of the softened rubber, such bodies can be obtained only, the walls of which at some sides are thicker than at others. If however, mechanical methods are used for making the raw rubber hollow body i. e. if the raw rubber is extended in the cold e. g. by inner air pressure within the mould and subsequently vulcanised in the same mould, a hollow body is obtained with throughout uniform walls.

This knowledge is particularly important in connection with the manufacture of hollow rubber toys of big size, the wall thickness of which is in comparison to small figures, relatively slight, with a view to prevent excessive weight which might impair the practical use of the toy. If owing to the use of gas forming substances, some of the side walls of such hollow bodies become excessively thin, while at the same time at other parts the side walls are disproportionately thicker, then the vulcanized moulded body either completely collapses or it cannot be kept in balance owing to its faulty distribution of load.

It has been ascertained that manufacture on

a large scale of bodies of above 350 mm. height in universal moulds is practically impossible with the use of chemical inflating agents. Excessive thinning of the wall at some places could be prevented in that case only if such raw rubber sheets would be used already at the outset which are substantially thicker than the least thickness of wall necessary for the maintenance of the shape of the figure. However, in such case only very heavy and much more expensive moulded bodies, due to waste of material, could be produced.

This invention relates to hollow rubber toys produced in universal moulds, the height of which exceeds 350 mm. and the stamp-welded seams of which coincide with the vulcanisation ridges and is characterised by that the thickness of wall of its practically uniform sides corresponds to the least wall thickness necessary for the maintenance of the shape of the hollow body or exceeds this thickness of wall at most to a small extent.

Such hollow bodies of big size can be produced in a universal mould by using mechanical methods, i. e. by the introduction of f. i. compressed air as an inflating and extending means. In this case it is possible to produce from relatively thin rubber sheets hollow rubber toys of relatively great height, owing to the fact that due to the uniform extension of the cold rubber sheets, these may be employed in a thickness which having regard to the uniform thinning brought about at all sides by the inflation, yields—besides of some negligible local thinnings—the least wall thickness necessary for maintaining the shape of the figure.

We have found f. i. that in making according to the process of the invention a toy imitating a human figure, the height of which is 350 mm. its width at the widest body portion 100 mm. its depth at its deepest body portion 65 mm., a raw rubber sheet of such thickness must be employed the thickness of which will amount to $^{17}/_{10}$ mm. in the ready made figure after extension, that is to say about $^{1}/_{200}$th part of the figure height. This approximate ratio between figure height and wall thickness has been found also in case of making figures of correspondingly bigger size, of a rubber mixture of normal hardness usual for rubber toys.

If necessary, some sides or parts of the figure according to the invention being of practically uniform wall thickness, may be strengthened or supported in any known manner.

The figure according to the invention can be provided with the generally known whistles of metal or of rubber.

RUDOLPH FRAKNÓI.

PUBLISHED

APRIL 27, 1943.

BY A. P. C.

R. FRAKNÓI

HOLLOW RUBBER TOYS OF BIG SIZE AND PROCESS FOR THEIR PRODUCTION

Filed July 28, 1939

Serial No. 287,002

Fig. 1

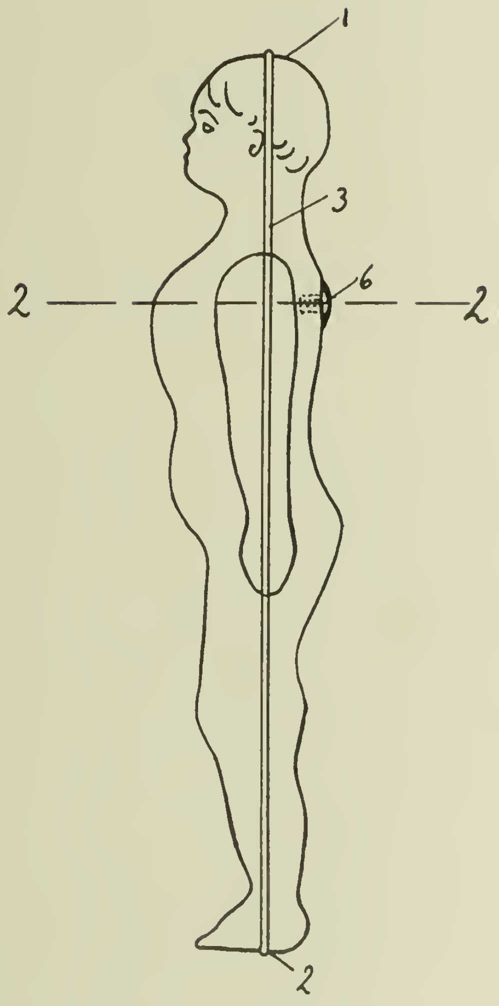
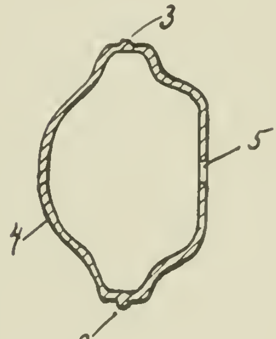


Fig. 2



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Published Apr. 27, 1943

Serial No. 287,284

ALIEN PROPERTY CUSTODIAN

INTERNAL COMBUSTION ENGINE

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Application filed July 29, 1939

The present invention relates to internal combustion engines and more particularly to a device for utilizing the energy of the exhaust gases from such engines.

It is well known that the power output of internal combustion engines can be increased when the energy in the exhaust gases is utilized for driving a supercharger to increase the charge to the engine or when, in the case of, for example, aircraft engines, the exhaust gases are allowed to escape in a direction opposite to that of the movement of the aircraft, so as to generate additional propulsion.

Hitherto the former measure has been used generally in the form in which the exhaust gases are compressed in front of the turbine and a fall in pressure to atmospheric pressure in the turbine utilized. This compression of the gases has, however, the drawbacks that the engine has to produce increased counter pressure during the exhaust stroke and that a greater amount of residual gases remains in the cylinder, so that both the charge and the output of the engine are reduced, and the temperature of the exhaust valve increased, leading possibly to its destruction through overheating. The result has been that the advantages of an exhaust gas turbine drive for the super charger as compared with a super charger mechanically driven by the engine are only slight, and it is not until high altitudes are reached that the superiority of the exhaust gas turbine driven super-charger becomes apparent. Moreover, in the case of aircraft it is desirable to increase the output of the engine when on the ground, in order to obtain rapid lift and climb. The increased output which this requires from the turbine driving the super-charger can, however, be obtained only by increased compression of the exhaust gases with its attendant drawbacks, which have led to a separate super charger driven by the engine being adopted for starting purposes.

In addition, the temperature of the exhaust gases from internal combustion engines is high and difficulties arise in the turbine drive, as the tensile strength of the rotating parts of the turbine decreases rapidly as the temperature rises. For this reason relatively slow running engines of great weight must be utilized. The fact that the manifold becomes red hot also tends to complicate construction and the exhaust valves are exposed to high temperatures which also influence their tensile strength and life.

Now, it has already been proposed to lower the exhaust temperature by mixing direct with the exhaust gases a portion of air conveyed by the supercharger by means of increased scavenging of the engine or by bye-passing the engine. However, some of the energy recovered from the exhaust gases is wasted owing to the necessity of increasing the output of the supercharger, the dimensions of which consequently also have to be increased.

On the other hand, when it is desired that the exhaust gases co-operate direct in generating propulsion, compression again becomes necessary and this involves the aforesaid drawbacks as regards greater counter pressure on the part of the engine during the exhaust stroke and more residual gases in the cylinder. In this method of utilizing the energy of the exhausting gases it is necessary to effect temperature reduction by admixing additional air in order to reduce the velocity of the exhaust flow by increasing the mass of the gas. High efficiency can be obtained only when the velocity of the exhaust gases is slightly greater than the speed of movement of the vehicle.

The object of the present invention is to provide a device for utilizing the energy of the exhaust gases of internal combustion engines by means of exhaust gas turbines or by means of recoil action, as a result of which air is added to the exhaust gases, the device being in the nature of a jet pump.

The aforesaid difficulties are completely eliminated by means of the new device. In principle it is no longer necessary to increase the size of the supercharger or to require from it a greater output. A separate supercharger driven by the engine for starting purposes is unnecessary.

According to the special constructional form of the present invention, the exhaust valve, the valve seat and the inner end of the exhaust manifold are designed in the manner of a jet pump, the valve and valve seat acting as enlarged nozzles which allow the gases to expand to below atmospheric pressure. This partial vacuum causes cooling air to be aspirated from the atmosphere, and the mixture of air and exhaust gases is then compressed to the initial pressure of the turbine or jet apparatus in a pipe line which acts as a diffuser. The admixed air increases the weight of the gas and lowers the temperature. In this manner the output of an exhaust turbine, where such is used, may be increased at moderate temperature, in order to increase the velocity and reduce the dead weight. This measure greatly benefits the engine, as the pressure behind the valve decreases to below ex-

ternal pressure and is equal to atmospheric pressure when the gas flow ceases, so that the residual burnt gases are thoroughly expelled from the combustion chamber and the counter pressure of the engine during the exhaust stroke reduced. The supercharging pressure may be increased for starting without unduly compressing the exhaust gases behind the valve, since the turbine has a high output when the pressure behind the valve is equal to the external pressure, inasmuch as the pressure at the end of the jet pump is higher than the pressure behind the valve. The valve and the valve seat are satisfactorily cooled by means of the incoming air, and this is of great advantage to the engine in many ways.

It is essential to the recovery of energy from the exhausting gases that the latter, which escape at a very high velocity, should not immediately be too suddenly deflected, as otherwise it will be impossible to obtain satisfactory working of the ejector constituted by the exhaust valve. For this reason care is taken to allow the exhaust gases to flow annularly through the ejector substantially in the direction of the valve stem after passing the valve.

In order to provide sufficient space for the control gear of the exhaust valve and to obtain efficient cooling of the valve guide it is preferable to divide the exhaust manifold into two or more pipes.

The invention is illustrated by way of example in the drawing in which,

Figure 1 illustrates diagrammatically a cross section through the cylinder of an internal combustion engine fitted with the device according to the invention, and

Figure 2 is a detail sectional view showing the construction and mounting of the valve.

The cylinder 2 of the internal combustion engine 1 expels the burnt gases during the exhaust stroke through the exhaust valve 3. The exhaust valve 3 co-operates with the valve seat 4 and with said seat constitutes a jet nozzle through which cooling air is aspirated through the branch pipe 5. The cooling air mixes with the exhaust gases and the mixture is compressed to the initial pressure of the turbine in the parts 6, 6′ of the exhaust manifold which parts act as a diffuser. The exhaust manifold is divided into two pipes 7, 7′, communicating respectively with the parts 6, 6′, this construction providing a simple valve guide 8 and providing space for the disposition and mounting of the valve control gear. The exhaust gases are fed to the turbine 10, and the latter drives the supercharger 11, which conveys the fresh air aspirated through the branch pipe 12 to the inlet valve 13 and thus to the engine 1.

JOHANNES SCHMIDT.

PUBLISHED
APRIL 27, 1943.
BY A. P. C.

J. SCHMIDT
INTERNAL COMBUSTION ENGINE
Filed July 29, 1939

Serial No.
287,284

Fig.1

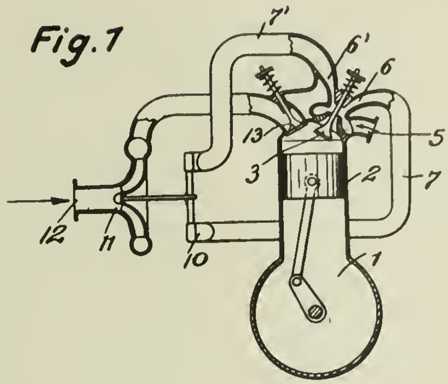
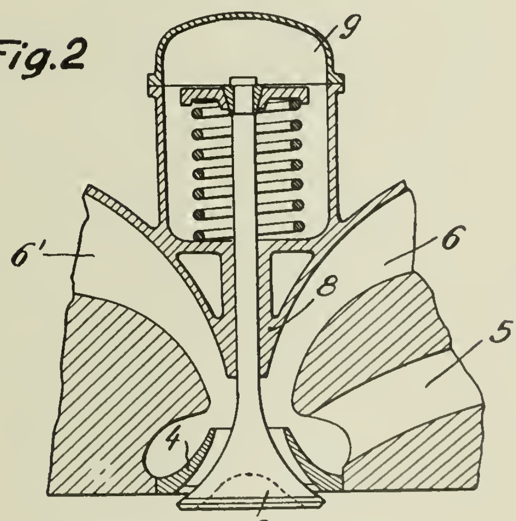


Fig.2



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Published Apr. 27, 1943

Serial No. 288,242

ALIEN PROPERTY CUSTODIAN

NON-SPLINTERING LAMINATED GLASS

Adolf Kämpfer, Berlin W 62, Germany; vested in the Alien Property Custodian

No Drawing. Application filed August 3, 1939

The invention of my present application, which is a continuation in part of my former application Serial No. 38,854, filed August 31, 1935, relates to laminated glass, in which the glass cover sheets are supported by a flexible intermediate layer.

Intermediate layers have long been employed for the purpose of holding splinters and of cementing the cover sheets together, their function in the case of fracture of the covering layers, being to prevent the glass splinters resulting from the fracture from being released, the intermediate layers by their adhesive action retaining such splinters in position. Security against fracture of such glass, which is the most important requirement if it is to have the character of safety glass, was not, however, at first ensured, since the thin intermediate layers then used were unable to prevent fracture. A certain degree of security against such fracture was subsequently obtained by employing tough, plastic intermediate layers e.g. of a natural or artificial resin with which has been mixed a small percentage of a vulcanisable rubber in solution, if desired with dissolved softening agents, and covering sheets of high oscillating powers, i.e. by employing glass covering sheets of only slight thickness e.g. 1 to 2 mms. the thickness of such intermediate layers being of at least half the thickness of the glass covering sheets employed.

Nevertheless the defect remained that relatively thin glass covering sheets of the laminated glass were unable to offer adequate resistance to additional stresses or strains arising during the construction or transport of the laminated glass but owing to the high flexibility of the intermediate layers, reached the breaking limit when subjected to bending strains, and were fractured.

This disadvantage resulted from the fact that the highly flexible intermediate layer could not afford sufficient resistance to the flexibility of the oscillatable covering sheets.

If, then, it was difficult with these oscillatable glass covering sheets to obtain an intermediate layer, which took up satisfactorily the normal stresses produced by warping or by transport of the additional stresses due to deformations taking place during the running of road or rail vehicles, it was even more difficult to combine thicker glass covering sheets having lower oscillating powers that is to say higher resistance to warping stresses or additional running stresses, because the high stresses in the intermediate layer resulting from deformation of the thicker covering sheets, were not counteracted by any adequate damping resistance.

With covering sheets of the order of 2,5 to 3 mm. in thickness, which have relatively low oscillating or flexing powers, but which are resistant to warping stresses, or the additional constructional or running stresses, intermediate layers which are thin and very flexible cannot be effectively used. Such covering sheets must be given a support capable by reason of its tenacity and elasticity of absorbing the bending forces, even under the strongest bending stresses, exerting a breaking action before any oscillation reaches its maximum.

This fact is taken into account by the present invention, which enables compound glass, having the maximum security against splintering and fracture, to be produced even when covering sheets which are practically non-oscillatory are used, and in which even the greatest constructional, transport or running stresses are scarcely capable of oscillating even through half a complete oscillation owing to their stability. It is furthermore highly desirable that these properties should persist throughout the ranges of atmosphere temperatures met with in all parts of the world.

The present invention involves two factors, both leading to the desired result, firstly, the choice of substance for the intermediate layer, and secondly the choice of the most suitable proportionate thickness of this layer in reference to the cover plates.

As substance I choose a polymer of vinyl acetate or a polymer of an acrylicacid ester, or a mixture of these polymers, the polymerisation being carried to the stage defined below and the polymer being treated as hereinafter described.

In order to obtain the maximum efficiency, however, this intermediate layer so prepared should be approximately 70 per cent of the thickness of the thickest covering sheet employed. The fact that covering sheets of different thickness are used being immaterial. Below this point the efficiency of the layer for the purposes abovementioned falls off rapidly, whilst a further increase in the thickness does not lead to any increase of efficiency commensurate with increased cost.

Although it is known that products of middle stage polymerisation of vinyl acetate or acrylic esters (as hereinafter defined) which possess great elasticity and flexibility, are well suited for use as intermediate layers to produce a non-splintering glass with adequate security against breakage, it has only recently been discovered

that, with thick layers, this security is confined to certain temperatures.

According to the present invention therefore the intermediate layer is formed from a polymer of vinyl acetate or from a polymer of an acrylic acid ester or from a mixture of these polymers, the degree of polymerisation being between approximately 720 and 800 (cf. H. Staudinger "Die hochmolekularen organischen Verbindungen (1932) pp. 41 to 45) i. e. a point between the middle and final stages for the following reasons:

The substances which are polymerised, and more particularly the one most generally used, viz. vinyl acetate, are given great resistance against cold and heat if the polymerisation is carried to the aforesaid degree of polymerisation.

As is well known, polymerisation consists in the union of molecules having unsaturated linkages to form a single molecule. The molecules so formed give a substance of excellent toughness and tensile strength and this elastic toughness and tensile strength is at the maximum when the polymerisation is almost complete. If the polymerisation was allowed to proceed to the final stage, however, difficulties would arise, in that the product being saturated would be very difficultly soluble.

Great difficulty has, however, been experienced in employing the aforesaid polymerisation products of a degree of polymerisation between approximately 720 and 800 for the purpose now sought, since it is necessary that permanent softening of this highly molecular body should be effected.

It has now been found that, contrary to prevailing ideas, these products of high molecular weight can be made to retain their properties permanently by the use of only a small proportion of softening agents. As, according to this invention, the solvents are not used for the production of the intermediate layers, the agents intended to produce permanent softening are added by the following method.

A polymerisation product which has reached the above described stage is a highly viscous mass of excellent tensile strength and elasticity, without being hard or brittle like crystal or glass, which would be the case with a product polymerised to the final stage. This product is disintegrated, and there is then added from seven to twenty percent, of a softening agent, the mixture being then heated and formed into a layer whose thickness is approximately 70% of that of the thicker cover glass. The mixture may be conveniently worked up in an autoclave by the use of suitable agitating means and heating up to approximately 80° C. so as to form a homogeneous mass. This mass cannot be made to flow at this temperature after absolute homogeneity has been obtained, but it is converted by the use of considerably higher temperatures, which may, if necessary, be raised to approximately 140° C., into a fluid or impressible condition, and then is immediately forced out of the vessel by high pressure, and at once formed into plates or foils from the desired form. The heating from 80° to 140° C. must take place relatively rapidly (for example during 60 to 80 minutes) so that no substantial further polymerisation takes place. It is important in this operation to employ as softening agents those high point esters which, at the temperatures in question, do not vary either in their colour or softening properties, since the intermediate layer must be fast to light and preserve its colour.

Suitable "softening agents" for the purpose of this invention are tributyl phosphate, tricresyl phosphate and dibutyl phthalate.

These intermediate layers are produced by one operation whatever the thickness required, and the former lengthy treatment for the purpose of removing bubbles and evaporating off the solvents is avoided.

Intermediate layers so produced have no powers of adhesion owing to the fact that no volatile solvents have been employed, and it is therefore necessary to provide for permanently connecting the intermediate layer of the sheets of glass in such a manner that splinters or fragments do not become detached even when the sheet is completely destroyed. It is advisable to use as an adhesive a strongly cementing solution produced from a middle stage polymerisation product of vinyl acetate or of an acrylic acid ester or mixture of these polymers dissolved in so-called genuine solvents of high boiling point.

By the term "genuine solvents of high boiling point" as used herein is meant difficultly volatilisable organic substances which are not soluble in, miscible with or capable of absorbing water, which have molecular weights of at least 100, and which boil without decomposition at ordinary pressure or in vacuum, their boiling points being not less than 165° C. at normal atmosphere pressure. Example of such genuine solvents of high boiling point are benzyl alcohol, glycol monobutylether, methyl cyclohexanol, methyl cyclohexanone, the acetate of methyl-1.3-butylene glycol, benzyl acetate and cyclohexyl acetate.

Apart from the strong adhesive powers of such solutions there is an advantage that foils covered with such solutions and used as intermediate layers absorb a part of these high boiling point solvents, and enter into intimate connection with the adhesive, and further the portions of the solvents which diffuse into the foils reinforce the action of the softening agents. I make no claim, however, to the use of any particular class or classes of adhesives.

I will now (by way of example only) describe two instances of these further stages of treatment after polymerisation.

Example No. 1

85 parts by weight of polymerised vinyl acetate having a degree of polymerisation of 747 are disintegrated and placed in an autoclave provided with stirring mechanism, and 14 parts of dibutyl phthalate, with a boiling point of 200–216° C. at 20 mm. pressure are poured in The autoclave is then shut and the stirrer slowly rotated. The steam pipes surrounding the autoclave are raised to a temperature of 120° C., and the rate of rotation somewhat increased. When the temperature of the jacket of the autoclave is seen to be 120° C., which would mean that the contained mass was at about 80° C., the rate of rotation is raised to 120 revolutions per minute. The homogenisation is continued at this temperature for three hours, when the mass should be completely homogenised. The temperature of the homogenised mass is now raised to 140° C (jacket temperature 180° C.) during two hours and the mass is then drawn off by a suction pump and applied to the cover sheet (to which an adhesive consisting of a middle stage polymerisation product of vinyl acetate in one of the aforesaid genuine solvents of high boiling point has previously been applied) by pressure through an application device.

The layer is formed with a thickness of 70 per

cent., of that of thicker cover sheet. The mass becomes solid immediately since no solvents have been used, the other cover sheet, to which an adhesive has previously been applied, is laid on, and the whole united in a press, at a temperature of 80° to 100° C.

Example 2

85 parts by weight of polymerised acrylic acid ester having a degree of polymerisation of 760 are disintegrated, 15 parts of diamyl phthalate with a boiling point of 210–220° C. under 20 mm pressure is added and the mixture treated as above described. A glass sheet covered with this intermediate layer is united by means of an adhesive with a second glass sheet according to the directions given in Example 1.

The two characteristic features of the invention are firstly the use of suitable highly viscous polymerisation products of high molecular weight, which can be converted into a fluid state by appropriate addition of softening agents and by the use of appropriate temperatures, and which can be formed under pressure into sheets of the required dimensions, and secondly that these intermediate layers are approximately seventy per cent. of the thickness of the thicker cover sheet of the laminated. Suitable glass for such purposes as windscreen can be formed with cover glasses of say 3 mm. thickness and an intermediate sheet of approximately 2 mm. If the cover glasses are of different thicknesses the thinner sheet should preferably be disposed on that side from which a blow is probable.

Since this invention enables glass of any desired thickness to be used, shop windows and the like may now be produced composed of laminated glass.

Laminated glass according to this invention is also found to be useful as walls for protection against heat and sound. The laminated glass according to the invention is therefore, also particularly suitable for use in the construction of telephone boxes for public telephone systems, and for microphone cells for wireless transmissions.

Another use of this glass is for the walls of explosion chambers and the like, where it is desirable to be able to inspect the interior, and at the same time protection must be afforded against any explosion. For example a suitable laminated glass for this purpose can be made from a sheet 10 mm. in thickness of ordinary window glass and another similar sheet of 4 mm. thickness, which are united by an intermediate layer of 7 mm. thickness.

By the expression "approximately 70%" as used herein is meant 60%, to 80%.

By the expression "middle stage polymerisation product" as used herein is meant one having a degree of polymersiation between 320 and 380.

ADOLF KÄMPFER.

Published Apr. 27, 1943

Serial No. 288,821

ALIEN PROPERTY CUSTODIAN

METHOD AND APPARATUS FOR RECOVERING SOLVENTS

Hiroshi Horio, Nishinariku, Osaka, Japan; vested in the Alien Property Custodian

Application filed August 7, 1939

The invention relates to an improved method and an apparatus for recovering solvents. The object of the invention is to provide means which are at once simple and economical and easy to carry out with high efficiency. According to the invention solvent vapour in a vaporizer is insulated from the outer air by injecting suitable vapours or gases which are readily condensible with the solvent vapour or do not prevent the condensation of same across an opening formed in the vaporizer, the solvent vapour mixed with a small portion of insulating media being conducted to a condenser where they are liquefied and separated.

As the solvent vapour in the vaporizer is wholly prevented from being mixed with air it may be easily condensed and, further, danger of explosion can also avoided. The condensation of solvent vapour is largely accelerated by fine particles of insulating media mixed which are formed as they are condensed. Complete condensation is also insured, the pressure of the mixed vapours in the vaporizer being kept higher than that of the outer air. In the invention the mixed vapours are directly sent to the condenser so that no means for absorption or purification are required. As insulating medium water vapour may be used with advantage.

The invention can be applied for the recovery of various solvents such as benzine, benzol, alcohol, acetone, ether and so forth.

The accompanying drawing shows a transverse sectional elevation of an apparatus according to the present invention as applied for the manufacture of rubber cloth.

A drum 3 rotatably mounted on a hollow shaft 7 is heated by steam introduced into the latter. The outer surface of said drum is mantled with a metallic plate except a portion of its periphery to form a vaporizer 5 which is provided at each end with a gas injecting chamber 6 with a longitudinal gap of proper size facing the outer surface of said drum.

Any suitable vapours or gases which are readily condensible with solvent vapor or do not prevent condensation of the latter is supplied into said gas injecting chambers through the conduits 8, 8. The pressure of gases introduced is maintained somewhat higher than that of the solvent vapour generated in the vaporizer.

A thin sheet of rubber 1 treated with solvent and still moist therewith and laid on a cloth 2 is passed over the drum and kept moving by rotation of the latter, when the solvent contained within is vaporized. On introducing water vapour into said gas injecting chambers by the conduits, a portion of it enters the vaporizer, while the main part thereof finds its way into the outer air, preventing the entrance of air into the vaporizer. The solvent vapour mixed with a little water vapour is conducted through a conduit 4 into a condenser where they are condensed and separated.

HIROSHI HORIO.

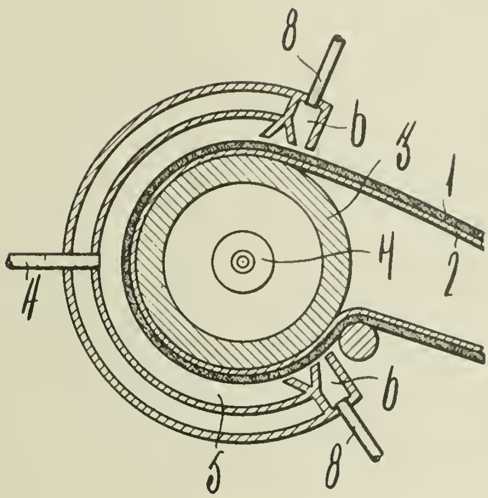
PUBLISHED

APRIL 27, 1943.

BY A. P. C.

H. HORIO
METHOD AND APPARATUS FOR
RECOVERING SOLVENTS
Filed Aug. 7, 1939

Serial No.
288,821



INVENTOR.
Hiroshi Horio.
BY Maxwell E. Sparrow
ATTORNEY.

Published Apr. 27, 1943 Serial No. 290,911

ALIEN PROPERTY CUSTODIAN

WHEELS

Paul Lemmerz, Konigswinter A.Rhein, Germany; vested in the Alien Property Custodian

Application filed August 18, 1939

This invention relates to wheels, particularly spoked wheels for vehicles of all kinds, and to a method of manufacturing such wheels.

In the manufacture of disc wheels, starting from the usual sheet material, circular discs are first cut out and these are then shaped by rolling and pressing to form the wheel disc. Since this process results in a considerable waste of material it has already been proposed to produce incomplete rounds or discs by first dividing the sheet material into rectangular plates, the edges of which are shorter than the diameter of the rounds to be produced. By this means, in stamping rounds out of these rectangular sheet metal members, the rounds obtained have rectilinear flats regularly distributed round the circumference. If from these rounds, by rolling and pressing, the flanging required for the dished portion of the disc wheel is produced, the front margin exhibits interruptions, without these interruptions on the other hand appearing on the wheel disc. By this known process, however, only a very slight saving of material can be obtained, since the wheel disc, which was obtained as such, constituted the greater part of the finished wheel disc.

According to the present invention the wheel disc is deliberately abandoned, and the wheel body is made in the form of a spoked wheel by pressing the wheel dish out of a polygonal section, the diagonal length of which is substantially less than the diameter of the round. The wheel dish pressed out of this polygonal section has the form of a spoked wheel, which has gaps between the ends of the spokes at which the connection to the rim is effected. According as a start is made from an octagonal, hexagonal or square blank, a wheel with eight spokes, six spokes or four spokes is obtained. The corners of the polygonal blank are preferably rounded, particularly when a square blank is employed.

For an extensive saving of material it may be advantageous to roll out the parts of the stamped polygonal blank diagonally in all directions uniformly to form lugs. The result is hereby obtained that the wall thickness gradually diminishes outwards, which at the same time corresponds to the diminishing stress owing to the particularly important bending moments occurring in operation.

It has been found that for the securing of the spoke body to the rim, flanges need not be provided on the corners of the polygonal blanks or on the rolled-out lugs, but that entirely sufficient strength of the wheel itself can be obtained when the spokes are butt-welded directly to the outer edge with the inner surface of the rim, particularly with the assistance of the electric arc process.

In order to enhance the strength of the wheel body it is advantageous to make the spokes of arched or other profile, and in particular it is advantageous to enhance the strength by pressing in ribs both in the spokes and in the main portion of the spoke wheel. In this case the ribs extend in a radial direction in the spokes, while the ribs in the main portion of the spoke wheel are formed as concentric circles extending round the rim. Owing to this increase of strength, the thickness of the sheet material may be less, thereby further decreasing the weight of the wheel and further economising material.

The invention is illustrated by way of example in the accompanying drawings, in which

Figure 1 is a diagrammatic plan view of a square sheet metal blank for a spoked wheel according to the invention, in comparison with the sheet metal blank hitherto required for wheels of the same size;

Figure 2 illustrates the method of manufacture with the corners of the sheet metal blank rolled out;

Figure 3 is an end view of a wheel dish with the rim put on;

Figure 4 is a radial section on the line 4—4 of the wheel shown in Figure 3;

Figure 5 is an end view of another form of wheel body, with wheel spokes butt-welded to the rim;

Figure 6 is a radial section on the line VI—VI of the wheel body shown in Figure 5;

Figure 7 is a cross section on the line VII—VII through one spoke of the wheel body shown in Figure 5, with an impressed rib;

Figure 8 is a cross section on the line VIII—VIII through an arched spoke of the wheel body shown in Figure 5;

Figure 9 is a cross section on the line IX—IX through the disc of the wheel body shown in Figure 5 with its free margin flanged; and

Figure 10 is a cross section on the line X—X through the disc of a wheel body similar to that of Figure 5 but with a radial partially cut spoke, the two sides of which are pressed asunder.

In the blank illustrated in Figure 1, a square metal sheet 1 forms the basis of the process of manufacture. This metal sheet is preferably cut from a universal iron bar. Hitherto the length of the edge of the square sheet metal blank 2 (shown in dot-and-dash lines) had to correspond at least

to the diameter D of the round, to enable the rounds to be cut out of the sheet. With the new process it is sufficient if the corners of the square sheet metal blank touch the circumference of the round, or preferably project slightly beyond the latter. Under these circumstances the circumference of the round serves as a measure, for the purpose of comparison, for the size of sheet allocated to a particular wheel diameter. From Figure 1 it can be seen that this involves a saving of about 30% to 40% of the material, if the four corners of the square project so far beyond the circumference of the round, that after the flanging at these points a reliable connection with the rim can be obtained.

In the case of a round diameter D of about 630 millimeters, such as has usually been employed for a wheel with a rim diameter of about 500 millimeters, a square sheet **2** having a length of side of at least 630 millimeters would hitherto have been needed. According to the new process a connection of sufficient strength between the four-spoke dish **10**, shown in Figure 4, and the rim **15**, is possible if at the corners of the square sheet **1**, the length of side of which, according to the new process, need only amount to 480 millimeters, arcs **3** of a length of about 120 millimeters are cut off by the circumference R of the round of diameter D.

A further decrease in the quantities of material can be obtained when the process is supplemented according to Figure 2 by rolling out the square sheet towards the four corners. In this case a start is made from a square sheet **4**, which, as compared with the square sheet **2**, shown in dot-and-dash lines, hitherto employed, contains only about half as much material. The four corners of the square sheet **4** are rolled out diagonally in the direction of the arrows *a* into lugs **5**, **6**, **7** and **8** until they reach the circumference of the round R, of diameter D, in sufficient breadth, that is, in about the same breadth as at the arcs **3** of Figure 1. This gives rise to a sheet **9** having a peripheral line composed of convex and concave arcs.

From the square sheet **1** of Figure 1 or from the sheet **9** of Figure 2 the wheel dish **10** shown in Figure 4 is now pressed. The edges obtained owing to the margin of the dish after pressing are indicated by dotted lines **3***a* in Figure 1 and **5***a*, **6***a*, **7***a* and **8***a* in Figure 2. A wheel with four spokes then comprises four recesses **11**, **12**, **13** and **14**, as shown in Figure 3, between the four spokes, these recesses also serving as hand holes, such as would otherwise have to be produced subsequently in the case of disc wheels by stamping out special holes for the purpose. This connection of the spokes with the rim **15** is quite sufficient to enable all stresses to be taken up, even if the size of the square sheet serving as an initial blank is diminished so far that the recesses **11**, **12**, **13** and **14** reach nearly to the hub circle **16**. Obviously the size and thickness of the spokes may be varied according to the strength of wheel required.

Any irregularities occurring owing to the rolling in the margin of the wheel may be compensated for by subsequently cutting the lateral edges to a uniform circular arc, as a result of which the appearance of the wheel will be improved.

In the same manner as has been explained in the two embodiments described above for a square blank, hexagonal or octagonal spoke wheels may also be made, according to whether universal iron bars, from which pieces are cut off, are adopted as the basis, or whether metal sheets are employed, from which regular hexagons or octagons or other polygons are rolled out. In the case of relatively large sheets and relatively small wheel dishes, hexagons present the advantage that waste only occurs on the margins of the metal sheets, since a surface can readily be divided into regular hexagons. The strength of the dish may be enhanced by pressing in ribs **17** in a manner known in itself.

In the embodiment illustrated in Figures 5 to 10, the wheel body **18** is welded to the rim **19** at **20** on the outer margin of the spokes. The spoke **21** is of arched cross section, as shown in Figure 8, while the spoke **22**, and also the part **23** between the spokes **21** and **22**, are provided with ribs **24** and **25** respectively. A cross section of the spoke **22**, with the rib **24**, is shown in Figure 7. The free margin of the spokes may also be turned inwards so as to form a short flange **26** for stiffening purposes, as shown in Figure 9. Finally the spokes may be so constructed that they are partly cut through, starting from the outer margin **28**, in the middle of the spoke, in a radial direction, as far as the point **27**. The spoke areas **27***a* and **27***b* thus produced are twisted relatively to one another so that the two spoke areas **27***a* and **27***b* assume an outspread position. At the points **27**, that is, at the end of the cut, and also at the points of connection of the ends of the spokes to the rim, welded seams are applied for the purpose of securing or strengthening the connection.

By this form of construction also a materially enhanced stability is attained, particularly against lateral bending stresses. By the form of construction according to Figures 5 to 10 a fifty per cent. saving of material is obtained as compared with disc wheels constructed in the usual manner.

The stiffening by means of ribs may of course be varied in any convenient manner, as may also the cross-sectional forms, according to the size and shape of the wheel.

PAUL LEMMERZ.

PUBLISHED
APRIL 27, 1943.
BY A. P. C.

P. LEMMERZ
WHEELS
Filed Aug. 18, 1939

Serial No.
290,911
2 Sheets-Sheet 2

Fig. 6

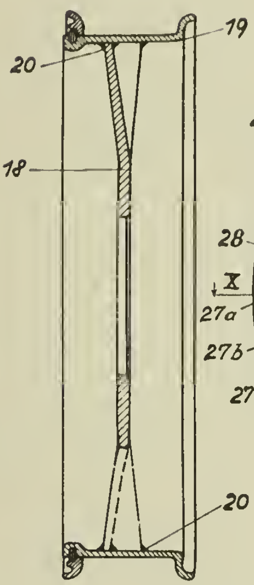


Fig. 5

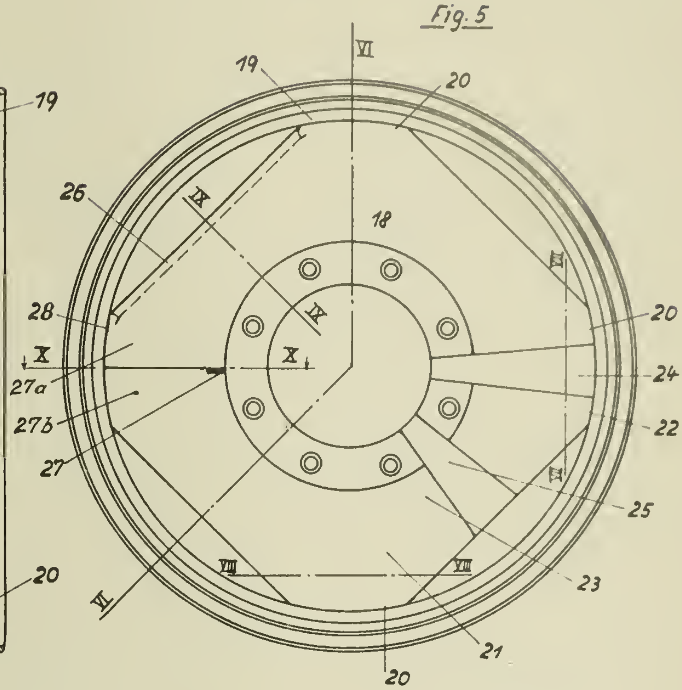


Fig. 7

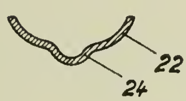


Fig. 8

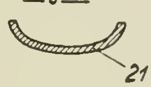


Fig. 10

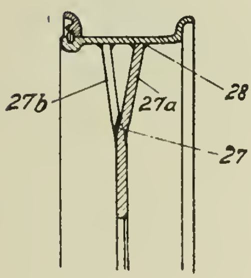
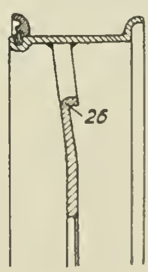


Fig. 9



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PUBLISHED

APRIL 27, 1943.

BY A. P. C.

P. LEMMERZ

WHEELS

Filed Aug. 18, 1939

Serial No. 290,911

2 Sheets-Sheet 1

Fig.1

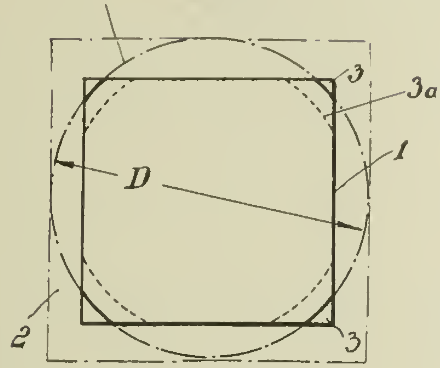


Fig.2

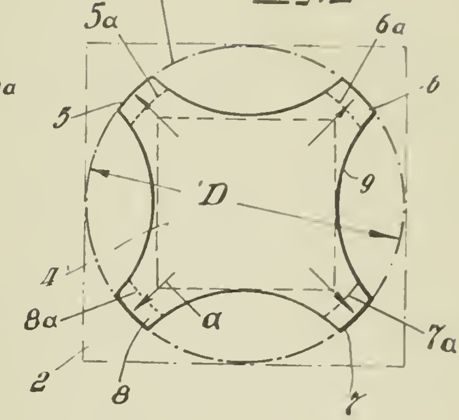


Fig.3

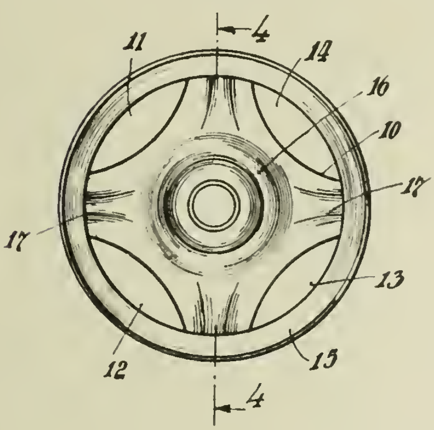
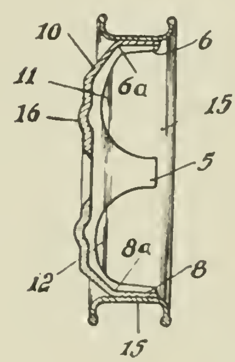


Fig.4



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Published Apr. 27, 1943

Serial No. 290,985

ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE MANUFACTURE OF HOLLOW BODIES

Viktor Ehrenhaft, Brunn, Moravia; vested in the Alien Property Custodian

Application filed August 19, 1939

This invention relates to a process for the manufacture of hollow bodies for building purposes, which bodies are made of some moldable material, for example, some porous building material, such as wood wool, wood fibres, wood chips, peat wool and the like, bound together by some adhesive. Although this process is not confined to the manufacture of hollow bodies of some definite shape, the said process will be now explained in connection with the manufacture of a molded body consisting of two sheets parallel to, and spaced from, one another and interconnected by a cross beam of angular shape interconnecting the two plates so that the said beam will by a certain length extend beyond the said plates, the said plates and beam forming one piece.

In the drawing, Fig. 1 is a perspective view of such hollow body according to the invention. The said body consists of prismatic plates **1** and **2**, parallel and adjacent to, and spaced from, one another, an angular beam interconnecting the said plates **1** and **2**.

The process for the manufacture of such body may be seen from Figs. 2 to 4, Fig. 2 showing on line II—II of Fig. 3 a section of the mold, in which the body is formed. Fig. 3 is a section on line I—I of Fig. 2 and shown in elevation. Fig. 4 is a plan section on line III—III of Fig. 2.

The mold is formed of a beam **4** which, for example, is made from wood and on which plates **6** and **7** are pivoted at **5**. For the purpose of forming the body, the mold is opened, the plates **6** and **7** getting into the position shown in dotted lines in Fig. 2. The said plates will thus lie horizontally, so that the material **8** previously produced by mixing its ingredients may be poured out upon the three parts **4**, **6** and **7** of the mold. If the layer of material poured out is of substantial height, care must be taken to prevent material from laterally escaping. For that purpose, the plates **6** and **7** are provided with slits through which sheets **9** and **10** are passed. The material is thereby laterally delimited. For the formation of the space between plates **1** and **2**, a core **11** consisting of two parts **14**, **15**, is placed into the mold. Such parts are preferably formed like wedges and so that they are provided with a gradient of cotter extending in two directions vertical to each other, as shown in Figs. 2 and 4. Such formation of the core is chosen in order to facilitate decomposition of the mold. The core is retained within the mold by a clamping device **12** not specified and not shown in respect of its details. These preparations having been made, compression of the material is effected by turning upward the side parts **6** and **7** of the mold about the axis of rotation **5**, so that their position becomes vertical, as shown in Figs. 2 to 4, parts **6** and **7** enclosing core **11**. When the mold is closed, the sheets **9** and **10** are adjacent to the core **11** and in this position are forced backward through the slits engaging them. The mold being closed, these sheets may be removed from the said slits. While the mold is being closed or after such closing, compression of the material below the core may be effected. Such compression may take place in two manners, one of which is indicated by arrows *b* in Fig. 2. The closed mold is forced against the retained core **11**, so that this core will be displaced relatively to the mold and the material **8** compressed accordingly and that until the desired shape of the body is attained.

The other possible course is to place the core into the mold, so that it may be displaced therein, and forced into the mold upward by means of a die not shown in the drawing, the mold remaining in its place.

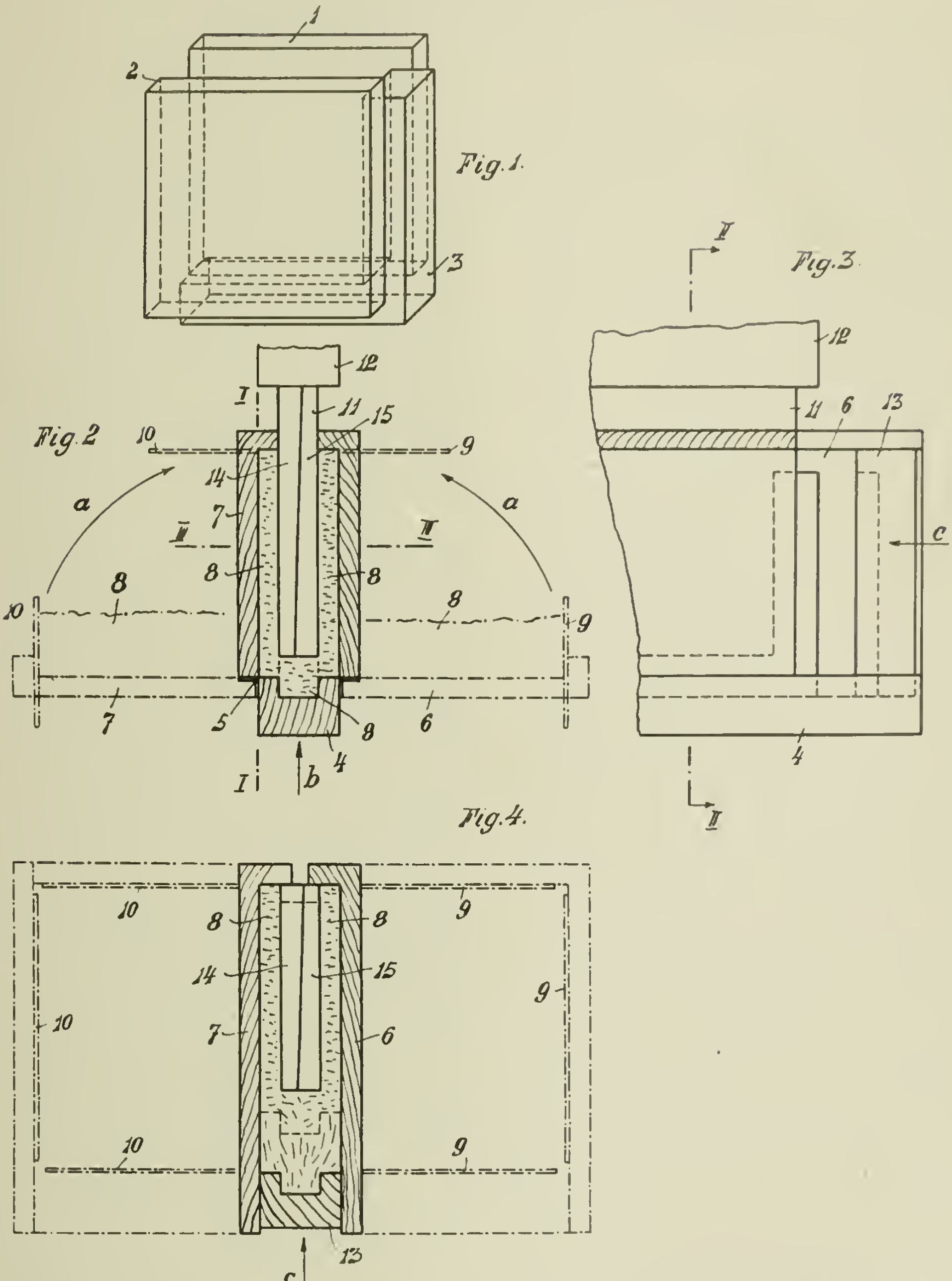
When forming the body according to Fig. 1, it is necessary during compression, to exert pressure to the material in the direction *c* shown by arrows in Fig. 3. For that purpose, a beam **13** is loosely inserted between the fixed plates **6** and **7**. This beam is displaced in a horizontal direction so that it may better penetrate into the depth of the mold. Pressure in direction *c* may be dispensed with in the case of bodies which are to be given another shape, without thereby altering the nature of the invention.

VIKTOR EHRENHAFT.

PUBLISHED V. EHRENHAFT Serial No.

APRIL 27, 1943. PROCESS FOR THE MANUFACTURE OF HOLLOW BODIES 290,985

BY A. P. C. Filed Aug. 19, 1939



Inventor

Victor Ehrenhaft

By

Published Apr. 27, 1943

Serial No. 291,581

ALIEN PROPERTY CUSTODIAN

PORTABLE BRIDGE STRUCTURE

Georg Thoféhrn and Heinrich Rauchholz, Berlin, Germany; vested in the Alien Property Custodian

Application filed August 23, 1939

Our invention relates to a portable bridge structure, that is, to a structure arranged to span an opening, and it is understood that we are not limited to bridges extending across water courses.

Our structure is made of light metal, and it is understood that the expression "light metal", as used in the following specification and the appended claims, includes the pure metal, for instance, aluminium, and any suitable alloy.

It is an object of our invention to provide a bridge structure which is light and comparatively small so that it is readily carried on vehicles of any kind, and is readily assembled and taken down, without the necessity of carrying heavy implements.

To this end, in a portable structure of the kind referred to, we provide not less than two girders placed side by side, each of which includes a top boom and a pair of bottom booms, all of light metal, and light-metal members connecting the booms to make up a lattice-work girder of triangular cross-section.

The light-metal booms are preferably profiled sections, and in one of the structures that will be described by way of example, the top boom is an inverted channel section, and the two bottom booms are angle sections. The light-metal members which connect the booms may be plain strips of sheet metal, or profiled sections, or tubes.

By these means, individual girders of light metal are produced whose length and weight are such that they can be carried and handled by a few men. In situ, the girders are placed side by side and connected by any suitable means so as to make up together a frame on which a floor can be placed. If desired, several frames can be connected at their ends for a bridge structure of great length, as may be required.

In the accompanying drawings, various structures embodying our invention are illustrated more or less diagrammatically by way of example.

In the drawings

Fig. 1 is an elevation, and Fig. 2 is a plan view, of a bridge consisting of six lattice-work girders of the type referred to.

Fig. 3 is a section on the line III—III in Fig. 2.

Fig. 4 is a cross-section of one of the girders, drawn to a larger scale.

Fig. 5 is a cross-section of a bridge structure comprising four girders arranged in upright position so as to support the floor of the structure by their top booms.

Fig. 6 is a similar section in which, however, the girders are inverted, that is, support the floor by their bottom booms.

Fig. 7 is a cross-section of a bridge structure in which the four girders are arranged in horizontal position, the top booms of each two girders are connected, and the floor is supported by those bottom booms which are at the top of the structure.

Fig. 8 is an elevation of a girder having solid walls so that it will float and is suitable for a pontoon,

Fig. 9 is a section on the line IX—IX in Fig. 8.

Fig. 10 is a cross-section of a pontoon girder in which a gas bag is inserted between the three booms.

Fig. 11 is a plan view of a structure consisting of five girders with staggered joints.

Fig. 12 is an elevation showing part of a bridge structure with two piers constructed like its girders and anchored on the ground with their lower ends.

Fig. 13 is a plan view showing the arrangement of four piers.

Fig. 14 is an end elevation of a pontoon comprising six closed girders as illustrated in Figs. 8 and 9, or Fig. 10.

Fig. 15 is an elevation showing part of a structure which is similar to that illustrated in Fig. 12 but whose piers are supported by pontoons.

Fig. 16 is an end elevation of a pontoon comprising three girders, and shows the means for detachably connecting the top booms of the girders to the top plate of the pontoon.

Fig. 17 is an elevation of a bridge structure whose girders are braced by plain compressional bars and tension bars.

Fig. 18 is a section on the line XVIII—XVIII in Fig. 17.

Fig. 19 is an elevation of a bridge structure which is similar to the one shown in Figs. 17 and 18 but has pyramidal structures instead of the plain compressional bars.

Fig. 20 shows one of the girders of the bridge illustrated in Fig. 19, viewed from below.

Fig. 21 is a section on the line XXI—XXI in Fig. 19.

Fig. 22 is a cross-section showing three girders whose top and bottom beams are hollow and built up from light-metal trapeze sections.

Fig. 23 is a section on the line XIII—XIII in Fig. 22.

Fig. 24 is an elevation showing a joint in the structure illustrated in Figs. 19 to 21, with the pyramidal structure referred to, drawn to a larger scale.

Fig. 25 is a section on the line XXV—XXV in Fig. 24.

Fig. 26 is a cross-section of a tubular, hexagonal, flanged member of light metal which is provided as the top boom and the bottom booms of the girders.

Fig. 27 is a cross-section of a bridge structure comprising a central bay and two girders with the built-up top and bottom booms illustrated in Figs. 24 and 25, at opposite sides of the bay.

Fig. 28 is an elevation of the structure shown in Fig. 27.

Figs. 29, 31, and 33, inclusive, with the cross-sections 30, 32, and 34, inclusive, as indicated by the section lines in the first-mentioned Figs., illustrate, respectively, a bridge having two girders at the sides of a central bay, as in Fig. 27, with a pyramidal compressional structure for each girder, a plain compressional member for each girder, and a pyramidal structure for the two girders together.

Fig. 35 is a cross-section of a bridge for heavy loads in which the system illustrated in Fig. 27 is supplemented by a similar system arranged symmetrically with respect to the first-mentioned system.

Referring now to the drawings, and first to Figs. 1 to 4, this bridge structure comprises six individual girders 28 placed side by side and connected by means which will be described with reference to Fig. 4. Each girder comprises a set of vertical struts 4 and of diagonal struts 5. One of the diagonal struts 5 is illustrated in detail in Fig. 4, it being understood that the construction of the vertical struts 4 is quite similar.

Each girder comprises a top boom 1, of light metal inverted channel section, and a pair of bottom booms 10 and 10′, also of light metal and of angle section. This section comprises a horizontal flange 8, a vertical flange 11 and a flange 12 at the upper end of the vertical flange which in the example illustrated includes an angle of 30° with the vertical portion 11. The booms 1, 10, and 10′ are connected by members which have been shown tubular, with flattened ends, but obviously may be of any other suitable construction. The side members 13*a* and 13*b* are connected to the corresponding flanges 9 of the channel top boom at their upper ends and to the inclined flange portions 12 of the bottom booms 10 and 10′ at their lower ends. A similar connection is provided for the base member 13*c* and the horizontal flanges 8 of the bottom booms. Screws 2 have been shown as the connecting means but it is understood that any other suitable means may be provided instead. The members 13*a*, 13*b*, and 13*c* are also made of light metal.

The girders 28, after having been placed side by side as shown in Fig. 2, are connected by screws 3, Fig. 4, which extend through holes in the vertical flange portions of their bottom booms 10 and 10′. The outer surfaces of the vertical flange portions 11 are forced against each other under the pressure of the screws 3 so that a very rigid structure is obtained. Obviously, other means than screws might be provided for connecting the girders 28, for instance, means including a camming member.

The girders 28 may be of any suitable length, the limit being the consideration of easy carrying and manipulation. A convenient length is about 30 feet. When the girders 28 have been connected, planks or sleepers 6 are placed on the webs of their top booms 10, and secured by any suitable means, and on the planks or sleepers is arranged the roadway 7 of the structure so that a solid floor is produced.

If desired, girders 28 may be abutted by their ends, and connected by any suitable means, as will be fully described, for a modified type of girder, with reference to Figs. 22 and 23, so that the structure becomes longer.

Referring now to Fig. 5, this shows the arrangement illustrated in Figs. 1 to 4, drawn to a larger scale and with four girders 28 instead of six. Otherwise, the structure is quite similar and need not be described more fully.

Referring now to Fig. 6, the girders 28 have been inverted, the top booms 1 being now at the base of the structure, and the floor 6, 7 being supported by the bottom booms 10 and 10′.

Referring now to Fig. 7, the four girders 28 are in horizontal position and in pairs, and in each pair the booms 1 at the top face each other and are connected by suitable means, for instance, screws, not shown. The bottom booms 10 and 10′ in the two central girders meet and their flanges 8 are forced against each other by the suitably elongated screws 2, or by any other means.

Instead of lattice-work girders, as described above, we may provide girders with solid walls of light-metal sheet or of impregnated fabric. Such closed girders will be used especially for pontoons.

Referring now to Figs. 8 and 9, this floating, or pontoon, girder *p* is provided with the top and bottom booms 1, 10, and 10′, as described, but its side and base members 14, 15, and 16 are plates of light metal braced by angle irons 18 and a row of bulkheads 20. Manholes 19 are made in the side plates 14 and 15, and closed by covers 17. This facilitates the assembling of the girders.

A pontoon girder may also be produced by inserting in a lattice work girder as illustrated in Fig. 4, a gas bag 21 of impregnated cloth or other suitable material which is inflated with air or gas. This is illustrated in Fig. 10.

Pontoon girders of the kind described may be used individually for the men who erect the structure to stand on, or they may be combined into a pontoon, as will be described with reference to Fig. 14.

As mentioned, it is possible to increase the length of a bridge structure by providing additional girders 28, and abutting these against those already in the structure. Preferably, the joints are staggered in this case, as illustrated at 26 and 27 in Fig. 11.

Referring now to Figs. 12 and 13, this bridge structure of which two lattice-work girders 28, jointed at J, are shown, is equipped with a pair of piers 34 and 35 mounted on a base plate or plank 36 from whose lower surface pins 37 penetrate into the ground to hold the piers against lateral displacement. A top plate 38 is secured to the upper ends of the piers and on this are mounted a pair of girders 39 and 40 extending horizontally and supporting the girders 28. The piers 34 and 35 and the horizontal girders 39 and 40 are light-metal lattice-work structures, like the girders 28 themselves. The piers are held in vertical position by guys only one of which is shown at 43. Its upper end is secured to the top plate 38, and its lower end is anchored in the ground at 44.

As shown in Fig. 13, the piers are so positioned that their small ends, where the top booms 1 are positioned, are directed against the flowing water, and the bottom booms 10 and 10′ extend transversely thereto. Planks 45 are then placed on the piers as a support for the girders 28.

Referring now to Fig. 14, this shows a pontoon P in which six pontoon girders of the type illustrated in Figs. 8 and 9, or in Fig. 10, are connected to a top plate 22.

Referring to Fig. 15, a pontoon P having nine pontoon girders *p*, supports a girder 47, also of light-metal lattice work, like the girders 28, and

on this girder 47 are arranged the piers 34 and 35, as described with reference to Fig. 12.

Any suitable means may be provided for securing the top plate 22 to the pontoon girders *p*. A preferred embodiment is illustrated in Fig. 16 where the top plate 22 is detachably secured to three pontoon girders *p* of the type illustrated in Figs. 8 and 9. Z sections 49 are placed on opposite ends of the top plate 22 and in each section is anchored a rod 51. A bracket 50 with a seat therein is secured to the inner side of that flange 9 which is at the outer side of the corresponding pontoon girder *p*. A handle 52 is fulcrumed on the lower end of the rod 51 and supports a cam 53 which when the handle is in the vertical position illustrated, engages in the seat in the bracket 50 and exerts tension on the rod 51. The hole in the side plate 14 or 15 of the pontoon girder must obviously be arranged above the water level, or be closed against access of water. The device which has been described is similar to the toggle lever system which is used for sealing bottles. This, or any other readily detachable mechanism may also be provided for securing the floor 6, 7 on the lattice-work girders 28.

Referring now to Figs. 17 to 21, inclusive, this bridge structure comprises a set of girders 28, of light-metal lattice work as described, which are subdivided into three sections 28*a*, 28*b*, and 28*c* by joints J' and J''. Both bridges are braced by tie rods 54, 55, and 56 below the girders.

In the bridge illustrated in Figs. 17 and 18, each of the four girders 28 which make up the structure is equipped with four vertical struts, 22 at the joint J', and 23 at the joint J'' and the tie rods are connected to the lower ends of the struts.

The bridge illustrated in Figs. 19, 20, and 21 is similar to the one illustrated in Figs. 17 and 18 with the exception that the struts 24 and 25 to which the tie rods are connected, have the shape of pyramids with rectangular bases. As shown in Fig. 20, the outer tie rods 54 and 56 may be duplicated.

Figs. 22 and 23 illustrate what may be termed a nested arrangement of lattice-work girders. The girders are no longer separate units, each with a top boom and a pair of bottom booms of its own, but each boom is, say, the top boom of one girder and, at the same time, one of the bottom booms of an adjacent girder. Therefore the distinction between top and bottom booms must be abandoned here, and the booms will be referred to as the upper booms 60 and the lower booms 61. Each boom is hollow and built up from three trapeze sections 62 between whose flanges 63 the flattened ends of the side members 13*a* and 13*b* are inserted and secured by any suitable means, not shown. The members 13*c* which in this structure are not base members but are alternately at the top and at the bottom and will be referred to as the horizontal members, are secured between the horizontal flanges 63 of the booms 60 and 61 and a cover 64 on the open side of each trough-shaped boom which not only acts as the cover but also braces the corresponding boom. Preferably, the girders at the sides of the bridge are made with solid walls, as in Figs. 8 and 9, because this makes an efficient and solid connection.

The girders are connected at their sides by bolts or slides 65 whose cross-section is similar to that of the trough-shaped booms 60 and 61 into which they are inserted and held by bolts 66 extending through holes in the bolt and the booms which the bolt connects. The ends of the bolts are hook-shaped and the bolts are introduced through the holes with their hooks and are then turned through 90°, as is well known in this art.

Referring now to Figs. 24 and 25, these illustrate the region of the joint J', Fig. 19, as modified for the hollow or trough-shaped booms 61. Secured below the plates 64 of the booms are troughs built up from trapeze sections 62' with flanges 63' which together with the booms make up a tube of hexagonal cross-section. The members 67 and 68 which make up the pyramid 24—a triangle at either side—are connected to the corresponding flanges 63 of the lower troughs at their upper ends, and their lower ends are secured between the upwardly extending flanges of a Y-section gusset plate 69 which also receives the tie rods 54 and 55.

A fillet 70 is preferably inserted between those flanges 63 or 63' that do not support a side member or pyramid member.

Instead of built-up booms, as described, tubular booms may be provided with which the ribs are integral. Fig. 26 shows a cross-section of a hexagonal tube 71 with six radial ribs or flanges 72.

Referring now to Fig. 27, this bridge structure has two girders 28 of the inverted type illustrated in Fig. 6 at opposite sides of the structure, and a central bay between the two girders. The girders are similar to the one illustrated in Fig. 4 but their booms 1, 10, and 10' are of the tubular built-up type, with trapeze sections 62 and flanges 63. The floor 6, 7 is supported by four cushioning members 73 engaging between the flanges 63 of the bottom booms 10 and 11, and is equipped with Z sections 49 at its edges, as and for the purpose described with reference to the pontoon structure in Fig. 17. Connecting members 83 and 84 extend, respectively, from the bottom booms 10 and 10' and from the top booms 1 across the central bay.

The position of the members 83 and 84 is illustrated in Fig. 28.

Referring now to Figs. 29 to 34, inclusive, these Figs. are self-explanatory after what has been said about Figs. 17 to 21, inclusive, and the variations which will be observed are only due to the fact that there are two girders 28 at opposite sides of a central bay. Thus, every girder 28 has its own pyramid 24, Fig. 30; there are only two struts 22 and 23, Fig. 32; and only in the structure illustrated in Figs. 33 and 34 does each pyramid 24 and 25 connect both girders 28 to the tie rods 54, 55, and 56.

If it is desired to provide a bridge for extra heavy load, the system illustrated in Figs. 27 and 28 is duplicated below the member 84 in symmetrical relation, Fig. 35. The top booms 1 are the same for both systems. The bottom booms for the lower system are designated 10'' and 10''', corresponding to the booms 10 and 10' of the upper system. The connecting member 85 in the lower system corresponds to the member 83 in the upper system, the member 84 belongs to both systems, and the central bay is braced further by diagonals 86 and 87 connecting the inner bottom booms in both systems.

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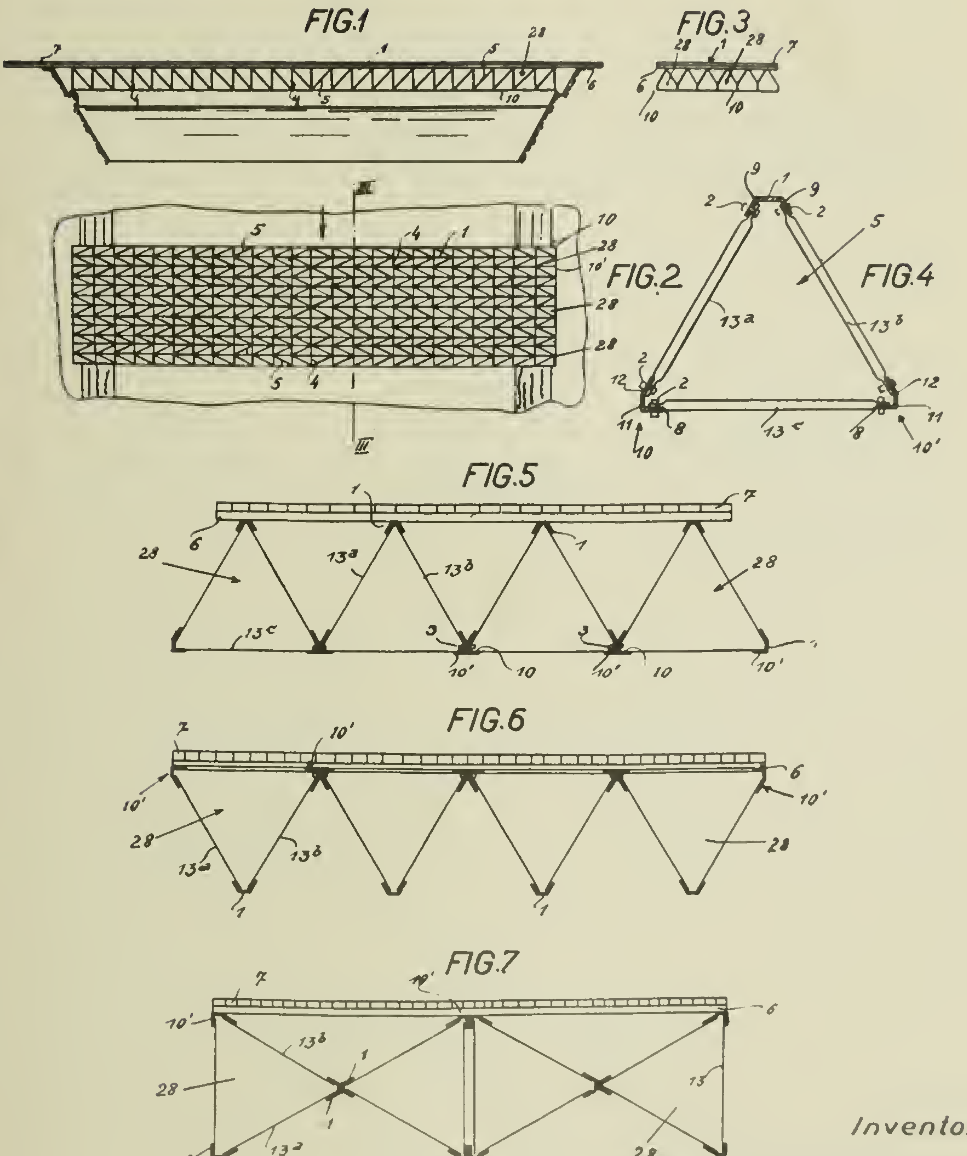
HEINRICH RAUCHHOLZ.

PUBLISHED
APRIL 27, 1943.
BY A. P. C.

G. THOFÉHRN ET AL
PORTABLE BRIDGE STRUCTURE
Filed Aug. 23, 1939

Serial No.
291,581
5 Sheets-Sheet 1



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Georg Thoféhrn
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PUBLISHED

APRIL 27, 1943.

BY A. P. C.

G. THOFÉHRN ET AL

PORTABLE BRIDGE STRUCTURE

Filed Aug. 23, 1939

Serial No.

291,581

5 Sheets-Sheet 2

FIG.8

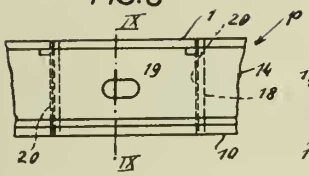


FIG.9

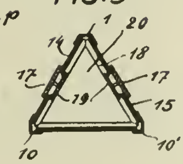


FIG.11

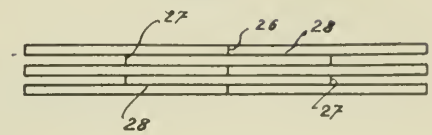


FIG.14

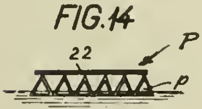


FIG.10

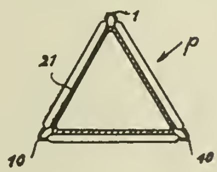


FIG.12

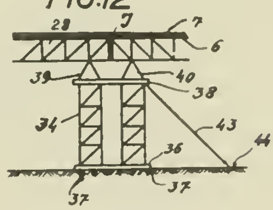


FIG.15

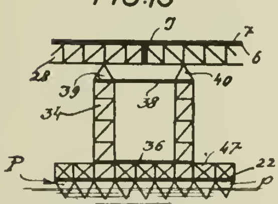


FIG.13

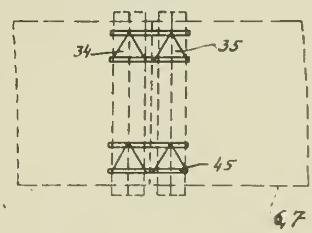
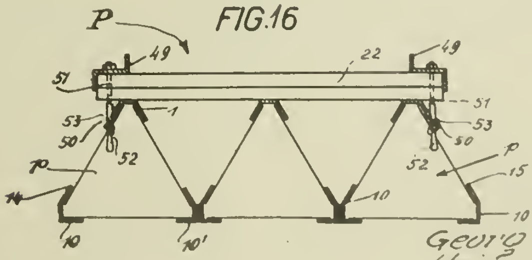


FIG.16



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By

Attorney

PUBLISHED
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5 Sheets-Sheet 3

FIG.17

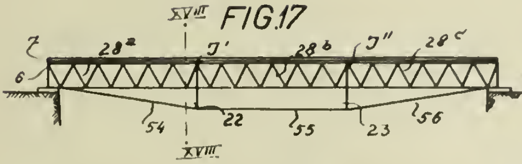


FIG.21

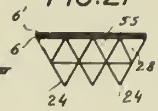


FIG.18

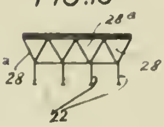


FIG.19

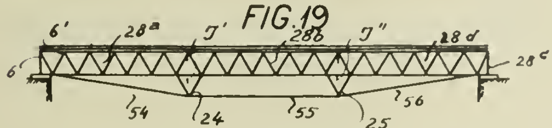


FIG.20

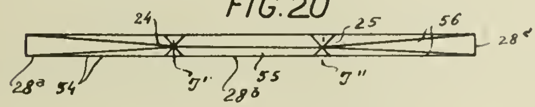


FIG.22

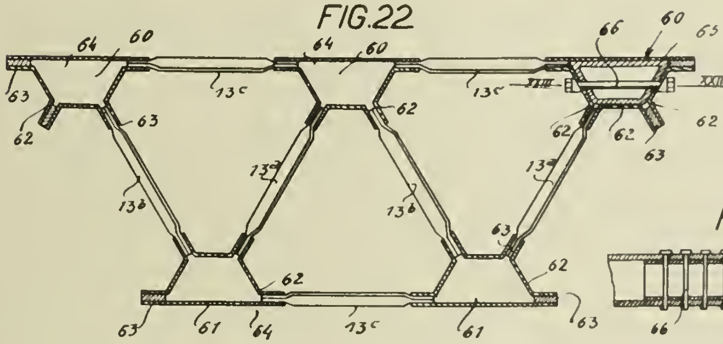


FIG.23

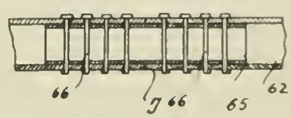


FIG.24

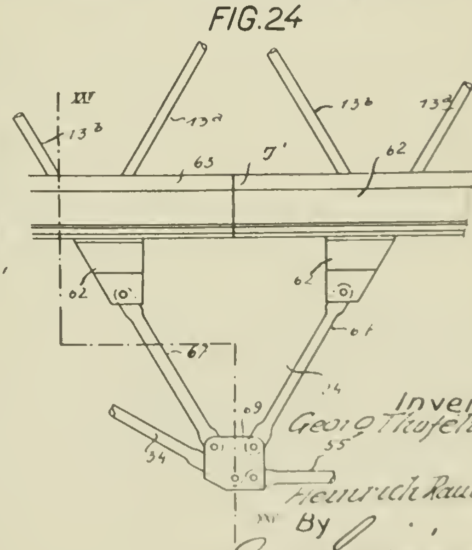
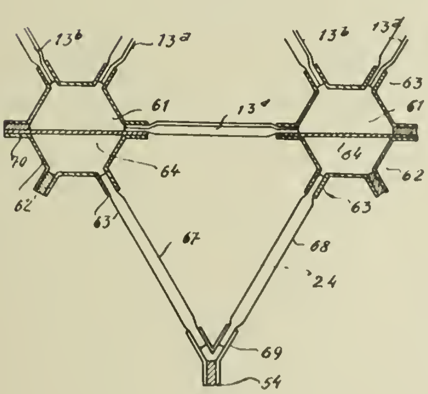


FIG.25



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PUBLISHED	G. THOFÉHRN ET AL	Serial No.
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BY A. P. C.	Filed Aug. 23, 1939	5 Sheets-Sheet 4

FIG.35

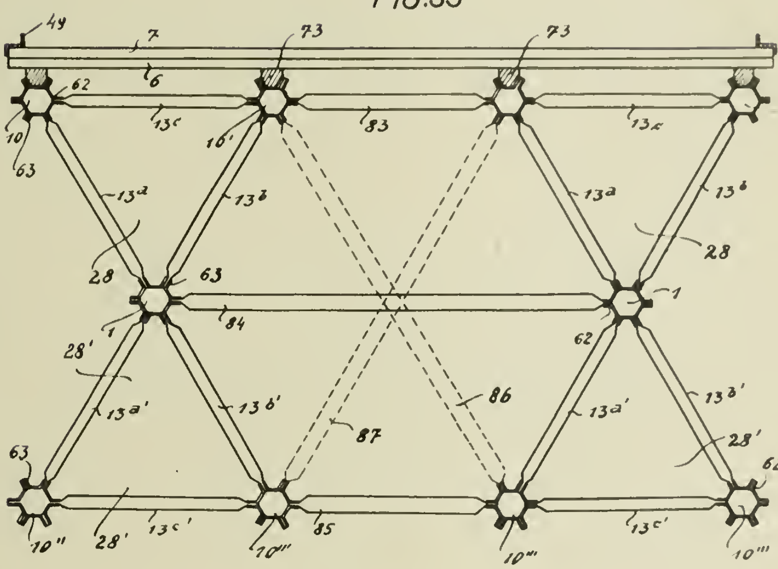
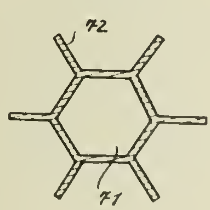


FIG.26



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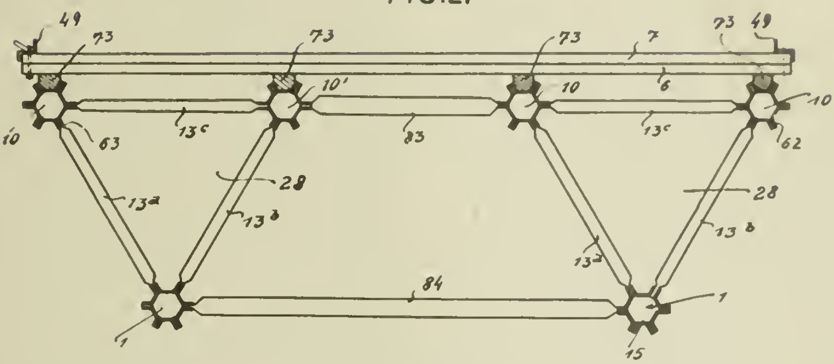
PUBLISHED
APRIL 27, 1943.
BY A. P. C.

G. THOFÉHRN ET AL
PORTABLE BRIDGE STRUCTURE
Filed Aug. 23, 1939

Serial No.
291,581
5 Sheets-Sheet 5

FIG.27



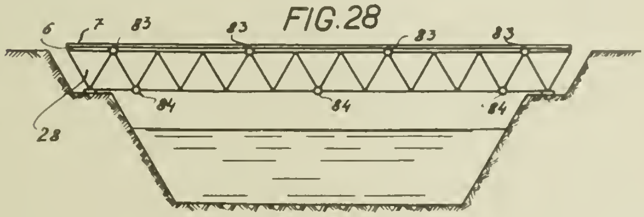


FIG.28

FIG.29

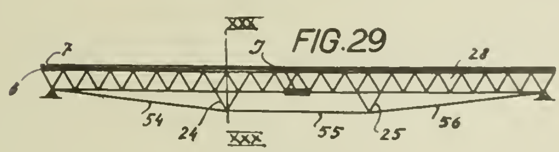


FIG.30

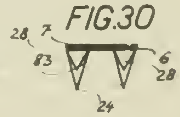


FIG.31

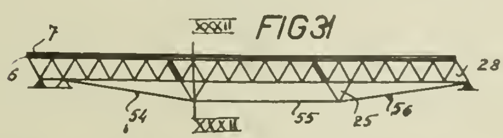


FIG.32

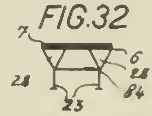


FIG.33

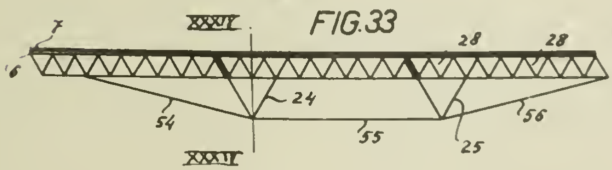
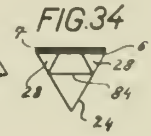


FIG.34



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Published Apr. 27, 1943 Serial No. 291,610

ALIEN PROPERTY CUSTODIAN

DEVICE FOR NAVIGATING SHIPS IN LOCKS, DOCKS AND SO ON

Heinrich Breitwieser, Griesheim, near Darmstadt, Germany; vested in the Alien Property Custodian

Application filed August 23, 1939

In navigating ships through lock installations according to the patent (Ser. N. 245290) there is an advantage if the towing means conducted in stationary guides with these guides are located below the level, i. e. below the surface of the plant of the surroundings of the lock (dock or the like) for the purpose not to hinder the traffic. This problem is not easy to solve, if sliding gates are used as it is usual at present in large sea locks. These sliding gates as well as the lock head project the surface of the plant, or the upper edge of these gates lie flush with said surface of the plant, whereby the chambers effect a complete interruption. By the present invention a solution is obtained in using articulated racks on which the ships are fastened. Said racks are so constructed to be capable of withstanding tension and compression and safe against bending.

First the one part of the articulated rack engaging the fastening means of the ship is made disconnectable from the other rack and connectable with a second rack. Each rack together with the disconnectable and connectable part conducts the ship through its cooperating lock-gate, for which this rack is used one for all. This latter is necessary, because at least one of the gates must be closed and because a single long continuous rack extending throughout would hinder the movement of the gate, if it is situated below the level. In this case the rack guides are arranged within a recess-like slot of the lockwall and the adjoining embankment near the upper edge of said wall. These guides are interrupted at the gate chamber and the connection is obtained by additional guides which are adapted on the front side of the gates. In this case the articulated rack can be moved throughout if the gate is in corresponding position within its chamber i. e. the gate is open.

Each of the articulated racks has its own stationary driving device.

The method of operating of this installation is explained in accordance with the drawings, in which

Fig. 1 is a diagrammatical plan view of a lock installation according to the invention,

Figs. 2–5 are sections of the articulated racks in various positions and the ship to be navigated.

Fig. 6 is a cross section through the gate chamber with opened gate.

1 indicates the entrance to the lock **4** and is situated between the directing arrangements **2** and **3**. Said lock can be closed by the outer gate **5** and the inner gate **6**. **7** indicates the exit which is located between the directing arrangements **8** and **9**. On both sides of the outer gate **5** dikes **10** and **11** are adjoining, the upper edge of the gate **5** is placed so high with regard to the high water as the crest of the dike (see Fig. 2). The inner gate **6** lies flush with the level of the plant.

Close below the upper edge of the lock wall or the wall of the directing arrangements respectively a slot **13** for the rack guides is provided within the concrete. In said slot the articulated rack can be moved by the winch work **15** and the rack **16** by the winch work **17**. The Fig. 7 illustrates a section on enlarged scale across the slot within the concrete of the lock with the rack guide and Fig. 8 shows a section across the front end of a gate with the rack guide arranged thereon. Fig. 9 is a section across the slot within the directing arrangements. Here two guides one above the other are arranged, the lower of which serves for reversing the rack, as is shown in Fig. 2 and so on. The outer gate ought to be open and the inner gate closed. A ship **18** navigated by her own power into the entrance is engaged with the half of the articulated rack **14** being at the top by aid of connecting means **19** (as shown in Figs. 1 and 2).

By actuating the winch work the ship is navigated into the lock **4**. In Fig. 3 the position of the rack is indicated by **20** and that of the ship by **21**.

Then the rack is divided. The part **22** to which the ship is fastened remains inside the lock while the other part is moved back upon the directing arrangement **3**. The gate **5** can now be closed and the water level is equalised with the water hight within the exit **7**. This position is illustrated in Fig. 4.

The gate **6** can now be opened and the rack is moved towards the left and coupled with the part of the rack **22**. Then the articulated rack is moved towards the right by the driving device **17** and the ship reaches the exit (position **22***a*) as shown in Fig. 5. After loosening the fastening means **19** the ship can now continue her passage by own power. If a second ship is to be navigated from the exit **7** into the entrance **1** in pursuance of the manoevring above mentioned. the operation is executed in reversed succession. In order to navigate a second ship from the entrance **1** into the exit **7**, the disconnectable part of the rack **22** must be moved back first and coupled with the articulated rack upon the directing arrangements **3**.

In order to secure the ship on both sides it is preferable for practical execution to arrange on both sides of the lock articulated racks and guides as well as driving devices.

It is an advantage to provide a particular guide for that part of the articulated rack engaging the fastening means of the ship which is disposed beside the proper guide of the articulated rack. In this manner the forces and strains respectively being exerted by the ship towards the bank are separated from those which are related exclusively to the movement of the articulated rack. Therefore the guides as well as the members of the rack being connected with the ship are constructed particularly strong for the purpose to absorb the lateral forces, while the articulated rack itself with its guide needs only be so strong as to absorb the pull and push forces in the longitudinal direction.

In Figs. 10–12 the feature of the present invention, as well as a series of construction details corresponding therewith are clearly explained.

Fig. 10 shows diagrammatically in a plan view a lock gate **23** with the gate chamber and the adjoining parts of the lock **25** and the entrance **26**. The ship **27** is held on two members **28** and **29** by aid of fastening means **30**. Said members **28** and **29** which correspond to one part of the articulated rack according to the construction described above and shown in Figs. 1–5 are conduced upon a guide **31** within the concrete of the bank, whereby the lateral strains are especially considered, for which purpose large guide rollers **32** are provided (see section in Fig. 11).

The movement of the members **28** and **29** is obtained by the articulated rack **33** which is conducted in guides **34** and driven by the winch work **35**.

The gate **33** is provided on its front side with a recess **36** corresponding to the slot within the concrete if the gate is open. Within the recess a guide **37** for the articulated rack is provided, so that the latter can be guided over the gate chamber **24**.

The movement of the members **28** and **29** over the gate chambers is made possible thereby, that these members are rigid and multiple so long as the breadth of the gate chamber. A guide of these members within the recess **36** of the gate is therefore not necessary.

The operation of this installation is executed principally in such a manner, as described above with the difference that each of both the articulated racks employed in a plant remains unchanged, i e that it is not divided and that the two members **28** and **29** are coupled with both the articulated racks one after the other as required. The coupling is obtained by the members **38** and **39** as indicated diagrammatically.

If the gate **23** is closed it must be avoided at high water, that water enters through the recess **36** from one side of the gate to the other. This is obtained by a sluice **40** (Fig. 12) which is moved within the gate by a driving device **41** in such a manner that the recess **36** can be closed. The position of the gate is illustrated in Fig. 10 by dotted lines.

Also in this case it is possible for a practical execution to provide on both sides of the sluice articulated racks with their guides as well as members especially guided for fastening the ship.

HEINRICH BREITWIESER.

PUBLISHED

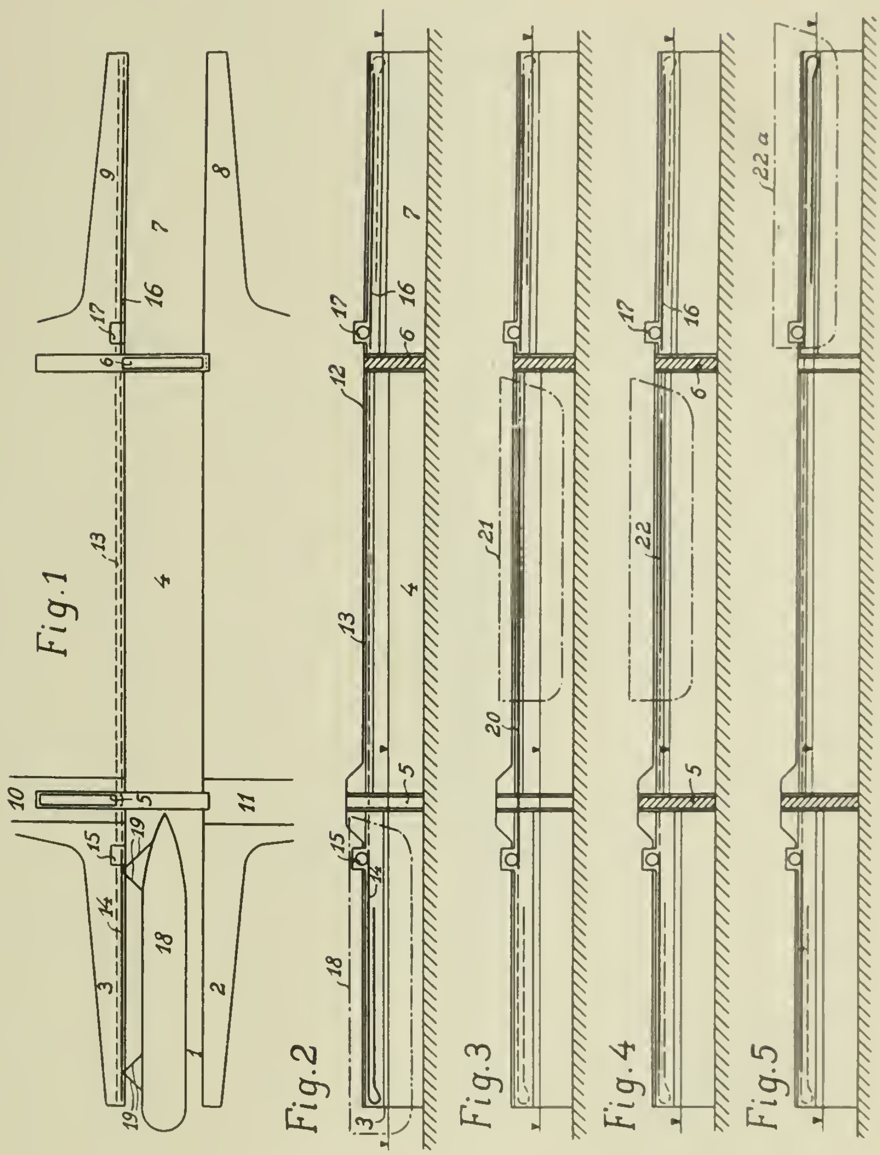
APRIL 27, 1943.

BY A. P. C.

H. BREITWIESER
DEVICE FOR NAVIGATING SHIPS
IN LOCKS, DOCKS AND SO ON
Filed Aug. 23, 1939

Serial No
291,610.

2 Sheets-Sheet 1



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By Wallenstein & Groff Attys

PUBLISHED

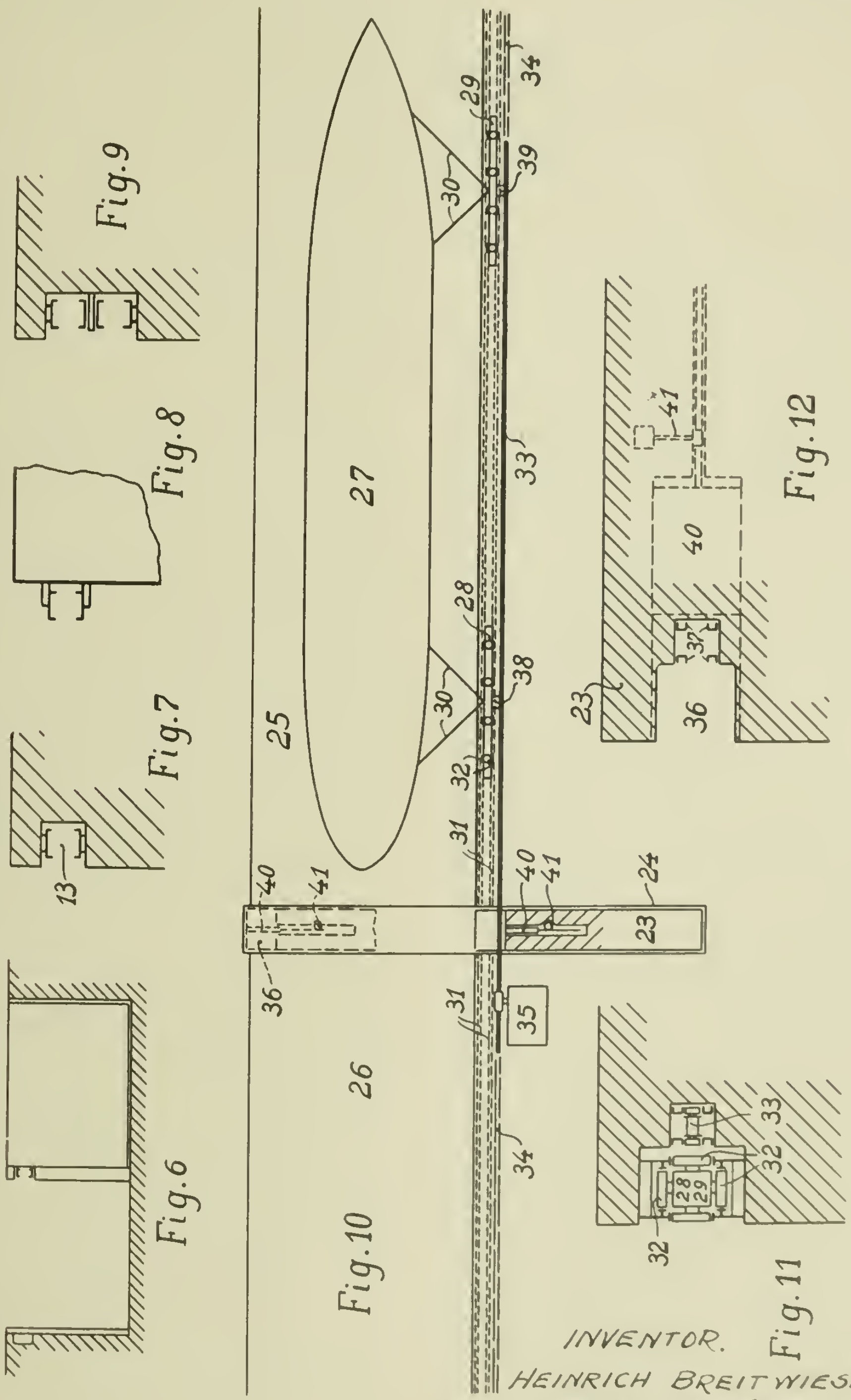
APRIL 27, 1943.

BY A. P. C.

H. BREITWIESER
DEVICE FOR NAVIGATING SHIPS
IN LOCKS, DOCKS AND SO ON
Filed Aug. 23, 1939

Serial No
291,610.

2 Sheets-Sheet 2



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Published Apr. 27, 1943

Serial No. 293,101

ALIEN PROPERTY CUSTODIAN

METHOD OF PREPARING SODIUM PERBORATE OF LOW BULK DENSITY

Hugo Nees, Francfort-on-Main, Germany; vested in the Alien Property Custodian

No Drawing. Application filed September 1, 1939

This invention relates to the preparation of sodium perborate of low bulk density. More particularly, it relates to the preparation of sodium perborate of bulk densities ranging from 100 to 200 grams per liter of volume, and to an improved process for preparing this relatively light and fluffy material.

The improved process for preparing this material in low bulk density involves reacting an aqueous solution of sodium hydroxide with an aqueous solution of borax and hydrogen peroxide in such a manner that the sodium perborate formed is maintained in a supersaturated condition in the liquid. The perborate is advantageously separated rapidly from the mother liquor and dried.

The solution of sodium hydroxide is preferably an aqueous solution containing, for example, about 200 grams of NaOH per liter. Sufficient of the solution is added to supply the amount of sodium hydroxide necessary to form sodium perborate by reaction with the borax present. The solutions are intermixed, at such a rate that it requires at least 5 minutes to add all of the one solution to the other. Preferably the solutions are intermixed at such a rate that from ½ to 2 hours is required. Any exceeding of 2 hours in the time required for adding one solution to the other does not result in appreciable improvement in the process or product.

By regulating the concentration of the solution of sodium hydroxide added to the solution containing borax and hydrogen peroxide, it is possible to influence the flowing ability of the sodium perborate being prepared. If relatively dilute solutions of sodium hydroxide are added, for example solutions containing approximately 40 grams of NaOH per liter, it has been observed that products having better pouring properties are secured than if the solution of sodium hydroxide is more concentrated. It is desirable to allow the solution containing borax and hydrogen peroxide to stand for a short period, for example from ¼ to 1 hour, after preparing this mixed solution. Improved results are also obtained by stirring the solution prior to introduction of the solution of sodium hydroxide.

The process is best carried out at temperatures below 30° C. and preferably temperatures between 5 and 15° C are maintained. During the addition of one solution to the other the reaction mixture should be thoroughly stirred. Separation of the sodium perborate in the form of fine particles is favored or accelerated by energetic stirring.

The pH value of the solution containing borax and hydrogen peroxide, at the commencement of operations, is usually within the range 6,7 to 7,2, when the usual commercial hydrogen peroxide solution which is acid in reaction is employed. As the solution of sodium hydroxide is added thereto the pH value is gradually increased. After the addition of the greater part of the sodium hydroxide solution the pH value then increases rather rapidly, for example, to a pH value of approximately 9. The solution becomes cloudy during the step of adding the solution of sodium hydroxide until finally the main part of the sodium perborate precipitates spontaneously in the form of fine particles.

It is desirable not to keep the precipitated crystals of sodium perborate in contact with the mother liquor for too long a period. The process of drying this sodium perborate product should therefore be carried out rapidly in order to prevent undesirable increase in size, and coalescing or growing together of the crystals which, if it occurs, will increase the bulk density of the product.

By carrying out the process as described it is possible to prepare sodium perborate which, after separation from the mother liquor and thorough drying, possesses a bulk density of from 100 to 200 grams per liter of volume. It may be stated, for purposes of comparison that sodium perborate obtained by processes now known to the art, e. g. by the introduction of sodium metaborate into hydrogen peroxide solutions, usually possesses a bulk density falling approximately within the range 650 to 670 grams per liter. Bulk densities even higher than these given may often be secured with the manufacturing processes now known in the art.

The preparation of sodium perborate of low bulk density, or sodium perborate which is relatively light and fluffy, is promoted by having present in the reaction liquid salts or compounds which favor or bring about the formation of crystal nuclei. As examples of such salts may be mentioned alkali metal salts, such as sodium chloride, sodium carbonate, sodium nitrate, sodium acetate, and the corresponding salts of ammonium and potassium. Soluble salts of the alkaline earth metals as, for example, the salts of calcium and barium are also effective. Salts or compounds of the metals, magnesium, aluminium, zinc and cadmium have also been found very effective in promoting the formation of crystal nuclei. Metallic salts suitable are the soluble formates of the metals mentioned, the citrates, oxalates, benzoates, lactates, propionates

and other salts of similar acids. It has been found that compounds such as the methyl ester of formic acid and similar esters are also valuable addition agents. Two or more compounds or salts promoting the formation of a plurality of small crystals may be added to the reaction liquor. The amount of addition agent is so regulated that the solution is unsaturated with respect to this agent. Usually from ½ mole to 3 moles of the addition compound or addition salt per mole of borax are added. When adding salts or compounds of the metals magnesium, calcium, barium, and the other alkaline earth metals, or of aluminium, zinc, cadmium and similar metals, it is desirable to introduce but relatively small amounts of the addition agent or compound.

The alkali necessary for the formation of sodium perborate from borax can, if necessary, be added to the solution either in part or in whole by compounds which supply sodium ions such as soda (sodium carbonate), trisodium phosphate and similar compounds.

If desired, a portion of the hydrogen peroxide, for example up to about one-quarter of the total amount of hydrogen peroxide necessary, may be added to the reaction mixture in the form of sodium peroxide. All of the alkali may be added to the reaction mixture in the form of this compound if desired.

The process is advantageously carried out by having present during the reaction a stabilizing agent such, for example, as magnesium silicate. This may be incorporated in the solution of borax and hydrogen peroxide before addition of the alkali thereto.

As examples of my improved process for the manufacture of sodium perborate of relatively light weight and low bulk density, the following may be given:

Example I

477 g. of borax was dissolved in 6500 cc. of water at a temperature of 40° C. The solution was thoroughly stirred during the dissolving operation. After cooling the resulting solution, 348 g. of crystalline sodium acetate, 450 cc. of hydrogen peroxide solution (40% by volume concentration) and 22 cc. of a magnesium silicate in water suspension were added to the solution of borax. Upon the addition of hydrogen peroxide the solution of borax became completely clear. Its pH value was approximately 6,8.

The resulting solution was allowed to stand for ½ hour during which period it was cooled to 10° C. A solution of sodium hydroxide containing 100 grams of NaOH in 500 cc. of water was then allowed to run in, the solution being added at such a rate that from 35 to 60 minutes was required for its complete addition. The temperature was maintained within the range 10 to 15° C. during the addition of the sodium hydroxide solution. During the entire time the solution was vigorously stirred with a high-speed rotating stirrer operating at from 3 to 5 revolutions per second.

Upon the addition of the solution of sodium hydroxide the pH value of the reaction mixture slowly increased. After approximately 15 minutes it attained a value of about 7, whereupon the solution became cloudy as the result of the precipitation of sodium perborate therein. After the addition of the sodium hydroxide solution for 10 minutes more, the greater part of the sodium perborate precipitated, the pH value of the solution increased very rapidly, and the liberation of considerable heat was noticed. After addition of all of the sodium hydroxide solution the solution was stirred for 20 minutes longer. It was then subjected to centrifuging in order to recover the precipitated salt. The salt was washed with water. After the product was dried in air and then subjected to further drying in a heated chamber under reduced pressure, there was obtained approximately 655 grams of sodium perborate. This product was of excellent stability and had a bulk density ranging from 100 grams per liter to 150 grams per liter. The yield of perborate was 85% of the theoretical. The mother liquor was then further utilized for the production of further amounts of sodium perborate by replenishing its active constituents and introducing thereinto further amounts of the sodium hydroxide solution.

Example II

A solution of 477 g. of borax in 6500 cc. of water was prepared. This solution was then cooled to 15° C., whereupon there was introduced thereinto magnesium silicate in aqueous suspension and 450 cc. of hydrogen peroxide solution (40% by volume concentration).

To the resulting solution there was then added 135 g. of soda (sodium carbonate), the addition being carried out in small increments while the solution was subjected to thorough stirring. After approximately 20 minutes the solution became cloudy due to the precipitation of sodium perborate therein. During the precipitation of the product the solution was cooled to 10° C. It required approximately 40 minutes for the complete addition of all of the soda.

After standing for a period of approximately forty minutes longer, during which as during the step of adding the soda to the reaction mixture it was subjected to vigorous stirring, the sodium perborate was filtered using a suction filter and freed of mother liquor. It was then washed with 3 liters of water and dried. At the conclusion of the drying step there was obtained about 420 grams of sodium perborate which had a bulk density of from 150 to 180 grams per liter of volume. The mother liquor was recovered, replenished by the addition of necessary agents, and reutilized for the preparation of further amounts of sodium perborate.

HUGO NEES.

Published Apr. 27, 1943

Serial No. 293,523

ALIEN PROPERTY CUSTODIAN

DEVICE FOR CONVERTING A CONTROLLING IMPULSE INTO AN ALTERNATING CURRENT IMPULSE

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Application filed September 5, 1939

The invention relates to improvements in devices in which an auxiliary force is controlled by measuring or regulating impulses for obtaining corresponding impulses of the auxiliary force. In particular the invention refers to devices of this kind in which a controlling impulse is to be converted into an electric current impulse. Such devices are specially suitable for controlling a physical condition, as for instance a temperature, a pressure, a quantity of a flowing medium, or for remote-transmission of a controlling impulse, such as a measuring or regulating impulse, as in such cases it is often necessary to adjust a controlled member, for instance an electric motor, in dependence on a controlling impulse.

The first object of the invention is to render the device suitable for converting even small impulses of any kind into considerably amplified electric a. c. impulses with a view to dispensing with additional current amplifying means. Furthermore the invention relates to the construction of the device so as to increase its reliability during operation and the accuracy of the measurement over the entire measuring range.

A further aim of the invention is to avoid in the device any reacting force prejudicially affecting the accuracy of the conversion of the controlling impulse.

The invention is more fully explained with reference to the accompanying drawings, of which

Fig. 1 shows an embodiment of the invention in which the device is designed for regulating purposes;

Fig. 2 shows a part of the device according to the invention in vertical section and in approximately natural size;

Fig. 3 represents a detail of the arrangement of Fig. 2 in cross section and on enlarged scale;

Figs. 4 and 5 show a further detail of the arrangement according to and on the same scale as Fig. 2 in two aspects, one representing a front view and one a cross section;

Fig. 6 shows a modification of the device according to the invention designed for remote-transmission of measuring values, while

Fig. 7 shows a part of the device according to Fig. 6 in vertical section and approximately natural size.

Fig. 1 shows diagrammatically an arrangement for maintaining a constant pressure in the conduit 180 by means of the throttle 190. *p* stands for controlled pressure behind the throttle 190. A pressure responsive means 15 having a diaphragm 1 acted upon by the pressure *p* is secured to the relay casing 19. The motion of this diaphragm is transmitted by means of a pin 16 to a lever 14 which is mounted in the casing 19 for movement around the axle 13. A spring 12 counteracts the pressure *p*, the counter-acting force of the spring being adjustable by means of a manipulated screw 3 screwed into the casing 19. The lower part of the relay casing 19 is constructed as a vessel 80 filled with an electrolyte. The lever 14 carries at its lower end two electrode plates 6, 6′ being electrically connected to and remote from one another. These electrodes are electrically connected, by means of a conductor in the interior of the lever 14, to a terminal 120. Each of the electrodes 6, 6′ faces one of two outer electrodes 8, 8′ which are rigidly connected to the wall of the vessel 80. The four electrodes are arranged in such a manner that the center electrodes 6, 6′ may be moved relative to the outer electrodes 8, 8′ in two opposite directions. The outer electrodes 8, 8′ are connected by mains 280, 290 parallel to the center tapped secondary winding S of a transformer T, the primary winding P of which is fed by the a. c. power source U, V. For the purpose of adjusting the throttle 190, a Ferraris motor F is provided. The Ferraris motor conventionally has two magnetic exciting field windings 50, 60 arranged vertically to each other. The winding 50 of the Ferraris motor is connected by a main 270 between the terminal 120 of the center electrodes 6, 6′ and the center tap 30 of the secondary transformer winding S. In this arrangement the device 80, 6, 6′, 8, 8′ acts as a potentiometer. The other winding 60 of the Ferraris motor is directly connected to the a. c. network U, V. The rotor 70 of the Ferraris motor F moves a worm 160 which engages a worm wheel segment 170 connected to the throttle, a movement of the worm 160 causing a movement of the segment 170 and consequently a movement of the throttle 190.

The spring 12 is so adjusted that the center electrodes 6, 6′ have at a certain pressure approximately the same distance with respect to the outer electrodes 8, 8′, i. e. zero potential. In this case the voltages between each of the electrodes 6, 6′ and each of the corresponding outer electrodes 8, 8′, respectively, are equal, so that no current flows through the exciting winding 50 of the Ferraris motor. As soon as the pressure changes, the lever 14 is displaced to the left or right and therefore a voltage is produced between the center electrodes 6, 6′ and the center tap 30 of the transformer T, the amount and

phase of which corresponds to the amount and direction of the displacement of the lever from its initial position. In consequence thereof a current flows through the winding **50**, the intensity and the phase of this current determining the rate and direction of the movement of the Ferraris motor. If the pressure at **15** is too large, the throttle **190** is moved by the Ferraris motor towards its closing position or vice versa.

The construction of the vessel containing the electrodes is more fully explained with reference to the drawings 2–5. As shown in Fig. 2, a supporting rod **2** of insulating material, preferably glass, is connected to the free movable end of the lever **19**. The supporting rod **2**, into which a conducting wire **10** is fused, possesses at its lower end two lateral extensions **4**, **5** of glass, each of which encloses a conducting wire **7**, **7'**, respectively, which are connected to the conducting wire **10**. The lateral ends of the conducting wires **7**, **7'** carry the electrode plates **6**, **6'**, said electrode plates **6**, **6'** forming together the center electrode. Each of the electrodes **6**, **6'** at a distance of about 3 mm faces one of the respective outer electrodes **8**, **8'** which are carried by the glass supporting members **9**, **9'** rigidly secured to the walls of the vessel **80**. Two conducting wires **11**, **11'** fused into the glass supporting members **9**, **9'** are connected to the electrodes **8**, **8'**, respectively, on the one hand and on the other hand to the terminals **140**, **140'**, respectively, on the walls of the vessel **80**, while the conductor **10** of the center electrodes **6**, **6'** is connected to the terminal **120** (Fig. 1). All electrodes are insulated on the reverse and at the edges, as may be seen in particular from the representation in Fig. 3 showing the mode of insulation of one of the center electrodes (**6**) in cross section on enlarged scale. The edge **12** of the electrode **6** is bent backwards. **13** represents a glass layer at the back of the electrode, which layer also encloses the edge **12**. Figs. 4 and 5 show one of the fixedly mounted electrodes **8**, **8'** in two different views on the same scale as Fig. 2. This arrangement has the advantage that the a. c. power may be controlled practically free from an undesired reacting force, as the displacement of the movable electrodes is very small and friction between contacts non-existent. The device may be controlled by any kind of mechanical impulse; such mechanical impulses may likewise be derived by way of conversion of an electrical impulse shifting the movable electrodes of the liquid resistance, for example by electromagnetic means. By constructing the center electrodes of two electrically connected remote parts **6** **6'**, each facing a fixed electrode **8**, **8'**, respectively, a considerable reduction of waste current between the two outer electrodes is achieved. In addition, the inevitable heat production is distributed over two places separated in space which favors the heat exchange in the surrounding liquid.

By insulating the reverses of the electrode plates it is ensured that the current flows only between the immediately juxtaposed surfaces of outer and center electrodes and no current is produced between the reverses of the opposed electrodes. The insulation of the electrode edges prevents a higher current density at these places than between the electrodes immediately facing each other. Thus the current flows only between the facing electrode surfaces with approximately the same current density. Consequently the steepness of the characteristic of the relay, i. e. the dependence of the controlled current fed by the center electrode on its displacement of the latter, is enhanced, which is of great importance for the operation of the relay. The insulating glass layer is fused on to the electrodes which latter are advantageously made of platinum black.

If it is desirable to avoid the loss of power occurring between the center electrode **6''** and the outer electrode **8''** not furnishing the controlled voltage and the heat development caused thereby, the relay system may be formed as shown in Fig. 6. This figure shows the relay built in a device for remote-transmission of a measuring value such as a quantity of a flowing medium. **90** represents a conduit line through which passes a medium in the direction of the arrow and the quantity of which has to be measured. **91** is an orifice plate in the line **90**, the difference in pressure between the two sides of the orifice plate acting upon the differential pressure meter **100**. The slack diaphragm **101** of this meter acts by means of a rod **92** upon a liver **94**, rotatably mounted at **95**, in the immediate vicinity of the pivot point of said lever. The lower end of the lever **94** carries an electrode **96** facing a fixedly mounted electrode **97** in such a way that the distance between the two electrodes may be varied if the lever is deflected. Both electrodes are immersed in a vessel **98** filled with an electrolyte. The liquid resistance created between the two electrodes is connected in series with a resistance **99** in the form of an induction coil. This series connection is supplied with electric energy by the a. c. network U, V. The a. c. voltage drop between the two electrodes resulting from a movement of the lever **94** in response to a measuring impulse is connected to the primary winding P_1 of the transformer T_1, the secondary winding S_1 of which feeds a full-wave rectifier R.

A coil **102** is secured to the upper end of the lever **94** thus forming a long lever arm. A fixed electro-magnetic coil **103** is provided, in whose field a coil **102** is movable. A series connection exists betweeen the output terminal **104**, **105** of the rectifier R, the coils **102** and **103** and a d. c. meter **106** which is connected to coil **103** by the main F_1 and to the terminal **105** of the rectifier R by the main F_2.

The force delivered by the dynamometric system **102**, **103** is proportional to the square of the d. c. flowing in the measuring circuit and counteracts the force acting upon the diaphragm **101** of the differential pressure meter **100**. The counteracting force due to the displacement of the diaphragm **101** in response to the differential pressure increases until equilibrium is established between the counteracting force and the differential pressure. The d. c. in the measuring circuit consequently is an exact measure of the square root of the differential pressure. The differential pressure being proportional to the square of the quantity flowing through the orifice plate, i. e. the quantity to be measured being thus proportional to the square root of the differential pressure, the deflections of the electricity meter **106** are a measure of the total quantity flowing through the conduit during a certain period of time.

In the arrangement according to Fig. 6 the heat development in the liquid resistance is reduced to the unavoidable amount. By using the induction coil **99** in line with the liquid resistance, the power loss of the wiring arrangement may be further decreased to a considerable extent as

compared with the utilizing of a liquid potentiometer as part of the relay.

Fig. 7 shows in detail the lower part of the relay shown in Fig. 6 in approximately natural size. The distance between the two electrodes **96, 97** is about 6 mm. The construction of the electrodes and of the supports for the electrodes exactly correspond to the construction shown in Fig. 2.

Experience has shown that a power of up to 30 watt may be obtained between the electrodes of the relay of the above described construction and of the size shown in Figs. 2 and 7.

Due to the loading of the current and the limited cooling, the electrolyte—if consisting of the usual aqueous solutions, as for instance a sodium chloride solution—is subject to a considerable rise of temperature, while its conductivity increases with increasing temperature. This causes an increase in the load current and an additional rise of temperature. Thus the heating of the liquid may easily reach an undesirable degree. This is due to the fact that the conventional aqueous solutions possess a positive temperature coefficient of electric conductivity, i. e. that their conductivity increases with a rising temperature.

This drawback may be eliminated by the use of a liquid of a constant or negative temperature coefficient. This results in the electric conductivity not changing with the temperature or its decreasing with a rising temperature. In any case, the load remains independent of the temperature. Such liquids are, for instance, a mannite-boric acid solution in the proportion of 121.1 g. of mannite and 41.2 g. of boric acid in a solvent of 1 liter of distilled water. The conductivity of this solution is 0.000953 cm^{-1} Ohm^{-1} at 18° C.

Even when using an a. c. of 50 periods or more, it is advantageous to operate with as low a tension as possible in order to avoid electrolytic decomposition and changes in the electrodes. The conductivity may be considerably enhanced by the addition of potassium chloride to the mannite-boric acid solution in the above-mentioned proportion. Fig. 8 shows the dependence of the conductivity on the temperature with reference to different additions of potassium chloride, while Fig. 9 shows the corresponding course of the temperature coefficient. If accordingly the addition of 0.125 g. of potassium chloride is chosen, the result is a solution of the greatest possible conductivity, possessing at the same time a negative temperature coefficient at a temperature lying above the operating temperature of about 48°. The conductive values of these solutions are as follows:

$$\left.\begin{array}{l} k=0.00118\ \mathrm{cm^{-1}\ ohm^{-1}\ at\ 18^\circ\ C} \\ k=0.00123\ \mathrm{cm^{-1}\ ohm^{-1}\ at\ 48^\circ\ C} \\ k=0.00122\ \mathrm{cm^{-1}\ ohm^{-1}\ at\ 65^\circ\ C} \\ k=0.00120\ \mathrm{cm^{-1}\ ohm^{-1}\ at\ 85^\circ\ C} \end{array}\right\} \text{(maximum)}$$

ADOLF KRÜSSMANN.

PUBLISHED

APRIL 27, 1943.

BY A. P. C.

A. KRÜSSMANN

DEVICE FOR CONVERTING A CONTROLLING IMPULSE INTO AN ALTERNATING CURRENT IMPULSE

Filed Sept. 5, 1939

Serial No. 293,523

2 Sheets-Sheet 1

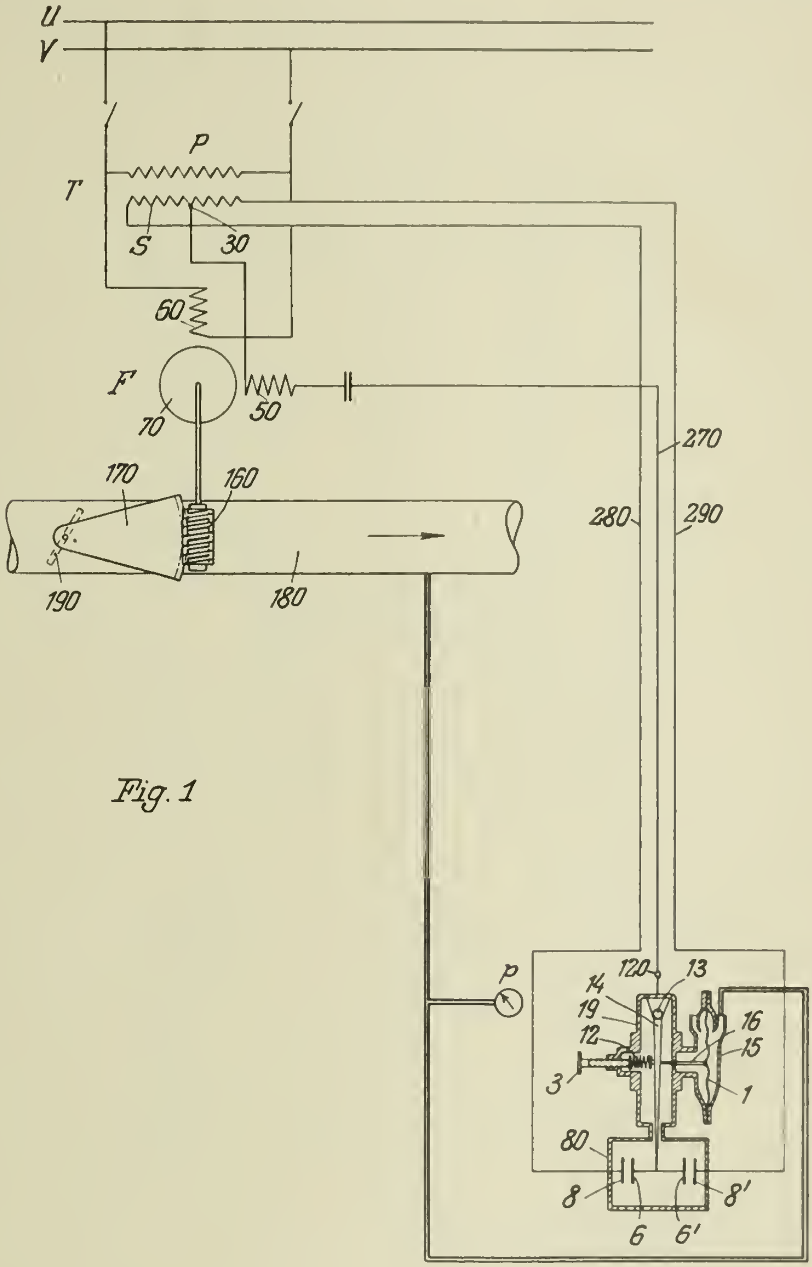

Fig. 1

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PUBLISHED

APRIL 27, 1943.

BY A. P. C.

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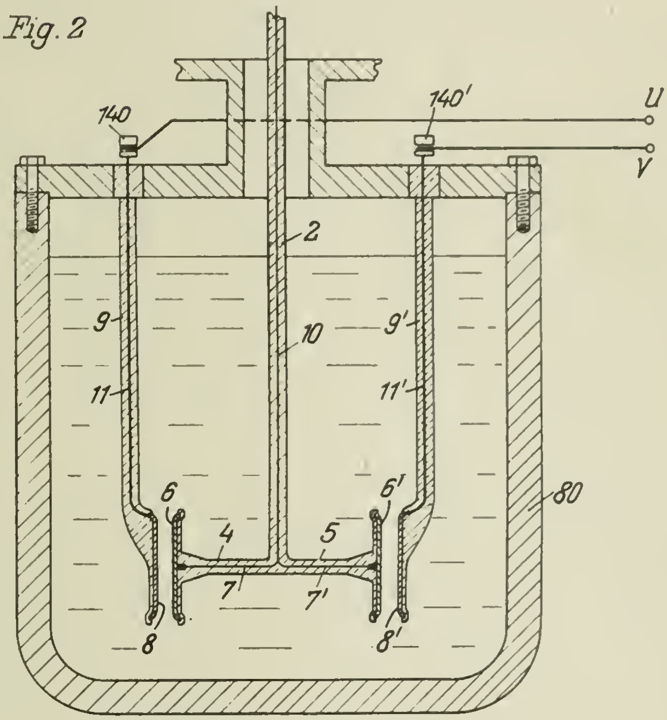
DEVICE FOR CONVERTING A CONTROLLING IMPULSE
INTO AN ALTERNATING CURRENT IMPULSE
Filed Sept. 5, 1939

Serial No.
293,523

2 Sheets-Sheet 2

Fig. 2



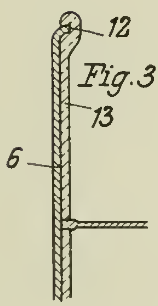


Fig. 3

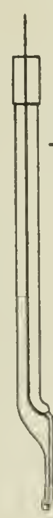


Fig. 4

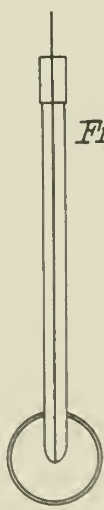


Fig. 5

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Published Apr. 27, 1943

Serial No. 295,028

ALIEN PROPERTY CUSTODIAN

METHOD AND MEANS FOR MANUFACTURING GLASS

Yvan Peyches, Paris, France; vested in the Alien Property Custodian

Application filed September 15, 1939

The present invention relates to furnaces for the production of glass of the type including a tank for the molten glass and in which the heating is obtained by the flow of electric current through the mass of molten glass.

The invention is applicable to the electric furnaces of the type above referred to in which the electrodes are located in the mass of glass between the inlet or chamber into which the raw material is introduced and the chamber from which glass is extracted, these electrodes creating hot zones which extend transversely to the path of the glass, substantially across the whole width of the furnace.

In the manufacture of glass, the treatment of the matter consists in a series of operations which take place in successive order and which are, as a rule, the melting operation, the refining operation and the bringing of the mass of glass to a temperature adapted to its utilization.

In furnaces of the type including a tank for the molten matters, as above mentioned, these various operations take place by the passage of the matter through a series of compartments or chambers corresponding to these respective perations and which are arranged in horizontal succession to one another. On passing from one chamber to the next one the state of the matter changes, that is to say the matter arrives in different states into the successive chambers. For instance, in the inlet or introduction zone, the raw materials, which are generally in the powdery state, are lighter than the mass of molten glass and, as a rule, they are more or less opaque to thermic rays. In the melting zone, the powdery matters melt, but as the molten mass contains a high proportion of gas imprisoned therein and therefore remains of lighter density than the fully treated matter, a freshly molten glass keeps floating at the top. Finally, in the refining zone, the molten matter is freed from its gaseous bubbles and therefore given a homogeneous state, becoming nearly transparent, while its density increases. Finally, in the zone where the mass is given the proper temperature, the last gas bubbles are driven off from the glass mass, while the latter gradually cools down from the refining temperature to the temperature of utilization.

As it is well known, it is possible to produce zones at particularly high temperature in the mass of the bath by means of electrodes transverse to the stream of glass flowing through the tank, said electrodes extending substantially across the whole width of the tank, between the inlet and the outlet thereof. These hot zones may be produced either by a pair of electrodes of opposite polarities, located at a short distance from each other, so that practically the whole of the energy supplied by the electrodes is utilized for heating a mass of glass of reduced volume. Or again a hot zone may be produced by a single electrode provided in the zone to be heated and the surface of contact of which with the surrounding glass is sufficiently small for ensuring a particularly high density of current in the vicinity of this surface whereby a considerable portion of the energy supplied by the electrode is spent in a zone of reduced volume surrounding said electrode.

In the embodiments of this kind of furnace which have been used in practice, the electrodes have been employed by distributing them in the melting and refining chambers, respectively.

The object of the present invention is to provide a furnace of the type above referred to which is more advantageous for practical purposes and, in particular, ensures a better efficiency.

With this purpose in view, an essential feature of the invention consists in localizing the whole of the electrodes in a zone of limited length in the longitudinal direction, this zone coming immediately after the introduction zone into which the raw materials are fed.

Owing to this arrangement, the whole of the heat given off by the electrodes, in the immediate vicinity thereof serves to the melting of the raw material introduced into the furnace. Said raw material therefore receives the benefit of the heat generated in all the glass zones which are in contact with the electrodes, said zones being those, as above indicated, in which the energy of the electric current produces the highest temperature.

I have found that by applying these high temperature zones wholly to the melting of the mass of glass, instead of distributing them in various portions of the furnace, I obtain, for a given consumption of power, a more active melting, owing to which the refining proper can take place in the zone following the melting zone, this result being obtained despite the absence of electrodes in the refining zone.

In some cases, it is possible, for a given consumption of electric power, to obtain, with the furnace according to the invention, better results concerning the quantity of matter treated, or the quality of the final product that is obtained than with the plants used up to this time, which included electrodes both in the melting zone and in the refining zone.

When carrying out the invention, it is advantageous to place the electrodes in the vicinity of the free surface of the bath, in such manner that said electrodes, and therefore the very hot zones that they produce around them, are placed inside the mass of matter to be molten. Furthermore, this arrangement has the advantage that the effect of the obstacle constituted by the electrodes

across the path of travel of said mass of matter is added to that of the high temperature, in that it retains the raw materials in the hot zone as long as they are not molten, then ensures the disintegration of the mass of raw materials as said mass is melting.

As the zone of contact between the matters to be molten and the hot melting surface is very shallow, it is advantageous, in order to ensure a sufficient value of this area of contact, to give the furnace, in the melting zone, a width as great as possible, greater than the width of the furnace in the regions of the furnace located behind said melting zone. This arrangement permits of reducing heat losses in the portions of the furnace located behind the melting zone and therefore contribute in increasing the thermic efficiency of the plant.

In order to obtain a melting zone of great size in the direction transverse to the direction of flow of the glass stream, the furnace, in the portion thereof that includes the inlet and the melting section is preferably, according to the invention, divided into a plurality of chambers, for instance convergent and opening all into a common chamber, or main section of the furnace. In each of these elementary sections or chambers, I may provide one or several electrodes each constituted by a horizontal rod of a length corresponding to the maximum length acceptable for the type of electrode employed. I can multiply at will the number of these elementary sections or chambers in order to obtain any desired dimension of the melting zone.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 is a horizontal sectional view of a furnace of the type above mentioned made according to a first embodiment of the invention;

Fig. 2 is a sectional view on the line II—II of Fig. 1;

Fig. 3 is a horizontal sectional view of another embodiment of a furnace made according to the invention;

Fig. 4 is a sectional view on the line IV—IV of Fig. 3.

The electric furnace shown by Figs. 1 and 2 includes two chambers **1** and **1**a, opening both into a common furnace section **2**. The raw materials to be treated are introduced into each of these chambers **1** and **1**a through loading orifices **3**, and the treated glass is extracted through outlets **4**. In the course of its travel from orifices **3** to outlets **4**, the matter is to undergo the various thermic treatments which are to take place successively for the treatment and production of glass.

For this purpose, I provide in each of the sections **1** and **1**a, behind the loading orifices or inlets **3**, two electrodes **5** and **5**a, each of which is arranged transversely to the path of the matter through the furnace, said electrodes extending from one wall to the other of said sections or chambers. These electrodes constitute the only glass heating means of the furnace. In other words, there are no other electrodes in the furnace. The electrodes **5** and **5**a of each couple of electrodes are of opposed polarities and the interval between them is sufficiently small for causing the electric energy fed through said electrodes into the furnace to produce a hot zone **6** which is of small length in the direction of the axis of the corresponding furnace section. This hot zone is constituted by annular spaces surrounding the electrodes, respectively, and the portion of the bath, of extremely short length, extending from one electrode to the other, the whole forming the melting zone above referred to.

A furnace such as above described will work in the following manner:

Upon being introduced into the furnace through an inlet **3**, a mass of raw material **7** enters zone **6**, where its melting takes place under excellent conditions, owing to the concentration of energy in said melting zone.

The refining operation takes place in a farther portion of the tank, in very favorable conditions, owing to the high temperature to which the matter has been brought by its passage through the melting zone, which temperature said matter keeps when leaving said zone.

Of course, instead of having couples of electrodes parallelly spaced apart from each other, I might make use of electrodes disposed in line with one another and electrically insulated from one another. In other words, according to this arrangement, I would use, for instance a single rod such as **5**, but made of one or more pairs of electrodes arranged in line and end to end but with a suitable insulation between the adjacent ends thereof, these elements being alternately connected to the two respective terminals of a suitable source of current.

In the embodiment illustrated by Figs. 3 and 4, the furnace according to the invention includes three elementary sections or chambers **1**, **1**a and **1**b, respectively provided with inlet orifices **3** and opening into a single main section **2** at the end of which are provided outlet orifices **4**.

In each of the elementary sections, there is a single electrode, respectively designated by reference numerals **5**, **5**a and **5**b. These electrodes are each connected to one of the phases of a source of three-phase currents. They are the only lectrodes present in the furnace.

The surface of contact of these electrodes with the mass of glass in which they are immersed is chosen of an area sufficiently low for obtaining a high density of current in their vicinity and thus producing a very hot zone around these electrodes.

With an arrangement of this kind, the matter to be treated in the furnace passes over a single electrode in the course of its travel through the tank. In other words, all the electrodes are in direct contact with the masses of raw materials before any melting of said materials. Now it has been found that the melting of the matter takes place under the best possible conditions when said matter is thus brought into contact with the electrode in the form of a coherent mass, whereas its melting is less complete when the matter in question arrives to the electrode in the form of lumps dispersed in molten glass.

Another advantage of this particular arrangement is that it permits of easily obtaining the balancing of the phases, since it suffices to act upon the position of the electrodes in their respective chambers or sections for modifying the mean distances between the electrodes, and in particular making these distances equal if necessary.

YVAN PEYCHES.

PUBLISHED
APRIL 27, 1943.
BY A. P. C.

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METHOD AND MEANS FOR MANUFACTURING GLASS
Filed Sept. 15, 1939

Serial No.
295.028
2 Sheets-Sheet 1

Fig. 1

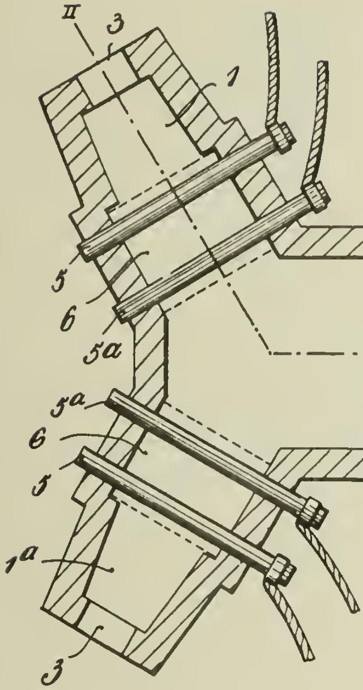
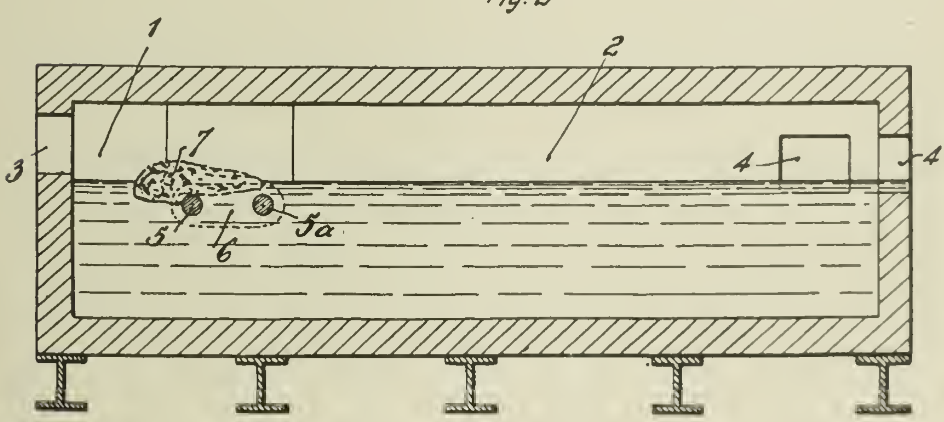


Fig. 2



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PUBLISHED
APRIL 27, 1943.
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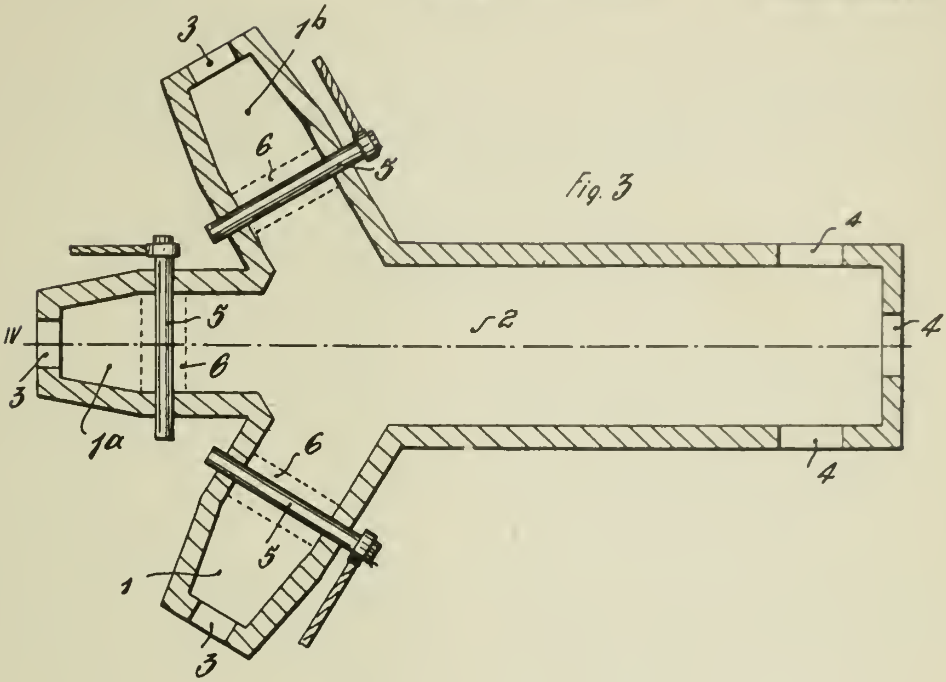
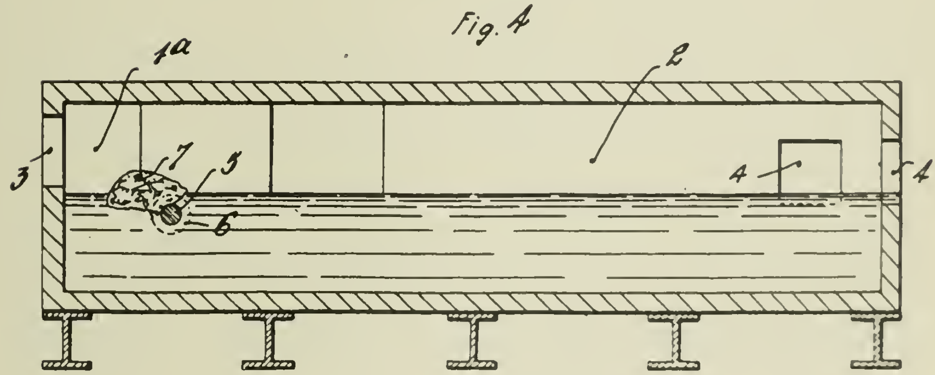
METHOD AND MEANS FOR MANUFACTURING GLASS
Filed Sept. 15, 1939

Serial No.
295.028
2 Sheets-Sheet 2





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Published Apr. 27, 1943

Serial No. 295,606

ALIEN PROPERTY CUSTODIAN

METHOD OF ADDITIONALLY HARDENING NATURAL OR ARTIFICIAL SUBSTANCES OF A PARTICULAR STRUCTURE HAVING LINEAR CHAIN MOLECULES

Willi Mertens, Berlin-Zehlendorf, Germany; vested in the Alien Property Custodian

No Drawing. Application filed September 19, 1939

This invention relates to a method of additionally hardening natural or artificial substances of a particular structure having linear chain molecules, polymerized according to the method disclosed in the copending application Serial No. 202,011, filed April 14, 1938.

The above copending application relates to a method of hardening polymerized natural or artificial substances consisting in homogeneously mixing these substances with an interpolymerizable mixture of at least two components capable of being polymerized, at least one of said components containing two groups capable of being polymerized and then in interpolymerizing the total mixture. This method lends itself particularly to substances of a structure having linear chain molecules and permits among other things the hardening of polyisobutylene. As an example of interpolymerizable mixtures of substances styrene+divinylbenzol is mentioned in the above copending application. The method according to the above copending application may be called a pseudo-vulcanization.

The invention consists in a method of additionally hardening natural or artificial substances treated according to the method as disclosed in the above copending application. This may be accomplished by subjecting these substances to a subsequent heat treatment. In this case by the expression "heat treatment", such treatments are to be understood as are generally employed for the normal vulcanization; i. e., for instance, the substances are subjected to steam at a temperature of 130 degrees centigrade; however, no vulcanizing agents are employed. The method according to the invention is particularly employed for polyisobutylene treated according to the method disclosed in the above copending application.

The products produced according to the invention have not only a particularly high degree of hardness but they present the great advantage in that they may be softened at individual or all points thereof by a mechanical operation and then rehardened by a further heat treatment. The mechanical operation may, for instance, consist in a kneading or rolling operation. Consequently, waste material may be utilized again when producing other products. To attain the desired hardness it is, as a rule, sufficient to heat-treat the products, for instance, for half an hour at a temperature of 130 degrees centigrade. Of course, in this case the hardening period besides being dependent upon the temperature depends also upon the thickness of the products to be hardened. It is preferable to carry out the method according to the invention in steam free of oxygen or in a protective gaseous atmosphere. The substances treated according to the invention have a low thermal conductivity. It is, therefore, preferable to quench the substances hardened, in cold water or in a cold current of air or in any other similar manner in order to avoid too long cooling periods.

The method according to the invention may also be carried out in the manner that materials treated according to the invention are mixed with pure starting materials; i. e., such starting materials which have not yet been hitherto treated according to the method of the above copending application. For instance, a substance, pseudo-vulcanized according to the invention and containing polyisobutylene, may be mixed with pure polyisobutylene. If the same degree of hardness is to be attained in this mixture as in the portion of the pseudo-vulcanized substance contained therein, a corresponding quantity of the interpolymerizable substance, i. e., for instance, of the styrene+divinylbenzol mixture, computated in accordance with the quantity of polyisobutylene is added thereto, considerable periods being then necessary to additionally harden the total mixture.

The above essential feature of the invention can be contributed to the fact that the particles of the interpolymerizable substance, i. e., for instance, of the styrene+divinylbenzol polymer, added according to the method disclosed in the above copending application conglomerate in a network-like manner owing to the heat treatment so as to form considerable complexes. This network is again destroyed by the mechanical operation.

The invention may, for instance, be employed in all such cases where products must be temporarily in a deformable state and temporarily in a less or non deformable state as the case may be. If therefore conduits for electric conductors, made of artificial substances are to be laid, the conduits may be first hardened according to the invention so that they are rigid or solid and do not sag when laid and the conduits are deformed to the desired degree by a simple mechanical operation at the points where there should be bends, curved tube portions etc.

WILLI MERTENS.

Published Apr. 27, 1943

Serial No. 298,514

ALIEN PROPERTY CUSTODIAN

COURSE INDICATOR DEVICE

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Application filed October 7, 1939

This invention relates to course and attitude indicating means for vehicles, and more particularly to such means for aircraft.

One of the objects of the present invention is to provide novel means for controlling an aircraft when changing from one course to another.

Another object is to provide novel means for controlling and indicating the attitude of an aircraft when in curved flight.

One of the objects of the present invention is to provide a novel mechanism of the above character which is light in weight and compact, therefore especially adapted for use aboard aircraft.

The above and further objects and novel features will more fully appear from the detailed description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for purposes of illustration only and are not intended as a definition of the limits of the invention, reference for this latter purpose being had to the appended claims.

In the drawings, wherein like reference characters refer to like parts throughout the several views,

Fig. 1 is an isometric view with parts broken away showing one embodiment of the invention; and

Fig. 2 is an isometric view of the apparatus in a housing having a face plate.

The form of the invention illustrated in the accompanying drawings, by way of example, comprises a course indicating device which can be employed for navigation and control purposes for vehicles such as aircraft. The device is provided with means for establishing a reference direction, for example, an azimuth gyro which is in gimbal ring suspension. Course indicium is operatively connected to the suspension and angularly shiftable with the gyro. A second indicium which is angularly adjustable in accordance with a desired course is co-axial with and adjacent to the first indicium. Suitable means are provided for producing impulses in response to departures of said indicia from a predetermined relation, the impulses being adapted for actuating control surfaces (not shown) of the vehicle. In order that the indicia be readily readable a suitable face plate having a window with a reference line or mark thereon is provided. Also in order to localize the means for indicating the movement of the craft about a vertical axis relative to a reference direction, and means for indicating the movement of the craft about a longitudinal axis relative to a horizontal plane a suitable transverse inclinometer is associated with the face plate in such a manner that it is adjacent said window and centralized in a position which is in alignment with said reference line or mark.

In the form shown in Fig. 1 means are provided for establishing a reference direction comprising, for example, an azimuth gyro which is angularly shiftable in a manner to appear later. The gyro arrangement is constituted by a rotor **10** having trunnions **10***a*. The latter are mounted in an inner gimbal ring **11** which is provided with horizontal trunnions **12**. The latter are supported in a conventional manner upon an outer gimbal ring **13** having vertical outer trunnions **14**.

Suitable means are provided for measuring the angular departure of a vehicle from a predetermined relationship to the above mentioned reference direction established by the gyro, comprising, for example, a disc member **15** which is preferably mounted at the center thereof upon one of the vertical trunnions **14**, said disc having an indicator or flange **16** thereon which is calibrated for angular measurement. A second disc member **17** is mounted coaxially with the first disc member and preferably closely adjacent thereto but sufficiently spaced therefrom to avoid frictional contact. Disc **17** is provided at the periphery thereof with a second indicator or flange **18** which is concentric with and equal in radius to flange **16**, flange **18** being calibrated similarly to flange **16**. The disc **17** and flange **18** are angularly movable with the vehicle. However, they may be angularly adjusted by any suitable means, for example, by a gear arrangement which is actuated by a manually operable handle **19** which is secured to a shaft **20** having thereon a bevel gear **21** which meshes with a second bevel gear **22**, the latter being secured to a shaft **23** which controls the angular position of disc **17** by means of a spur gear **24** which meshes with gear teeth upon the outer periphery of said disc. The opposite extremity of shaft **20** is operatively connected to means (not shown) for remotely controlling the angular adjustment of disc **17**.

In order that impulses be produced in response to angular departures of said discs from a predetermined relationship whereby, for example, control surface governing means can be actuated, a bolometer arrangement is operatively associated with the discs and with one of the trunnions **14**, comprising diametrically disposed nozzles **25** which are mounted upon disc **17** immedi-

ately beneath filaments 26 of a type normally used with such bolometers, said filaments being also mounted upon disc 17. A control diaphragm 27 is provided which is interposed between said nozzles and filaments to act as a control member for governing the flow of air or fluid to the filaments, said diaphragm being preferably fixedly secured to a trunnion 14.

An arrangement is provided for shifting the gyro in azimuth, comprising, for example, a hand knob 28 secured to a shaft 29 having thereon a bevel gear 30 which, upon sufficient axial movement of shaft 29, can engage a second bevel gear 31. Shaft 29 is normally retained by suitable means (not shown) in such a position that the bevel gears are not in engagement. In order that the angular moment of inertia of trunnions 14 be as small as possible a shaft 32 upon which the bevel gear 31 is mounted is disengageable from trunnion 14 by a suitable clutch 33, said clutch being movable into an operable engagement by a conical cam 34 which is mounted upon and co-axial with shaft 29. If the knob 28 is thrust inwardly and turned when the rotor 10 is in operation, the latter, of course, will tumble or precess about the axes of trunnions 12. Suitable means (not shown) for preventing such tumbling by clamping said trunnions or gripping the inner gimbal ring 11 are provided, said means being effective only when azimuth adjustments of the rotor are being made.

In Fig. 2 there is shown a particularly desirable and compact disposition of the indicating and control members of the present invention. The above-mentioned control knob 28 is preferably disposed in the left lower corner of a face plate 35 of a housing 36. One complete turn of said knob preferably produces an angular displacement of the gyro of 20 degrees. In the opposite lower corner of face plate 35 is the crank 19 which is employed, as above set forth, for adjusting disc 17 and thus "setting" the apparatus for a desired course. One complete rotation of crank 19 preferably displaces said disc 5 degrees. Between the above two control knobs and at a slight distance above them there is provided in the face plate an arcuate slot 37 having the lowest portion thereof in the center of the face plate and beneath the center of a preferably rectangular window 38 through which are viewed portions of the indicating flanges 16 and 18. Slot 37 exposes a conventional inclinometer 39 having a ball 40 therein which, when in a central position, is between two central vertical reference marks 41. Centrally disposed in the window 38 and in central alignment with ball 40, as shown in Fig. 2, is a center or lubbers line 42 against which can be read the calibrations of the above-mentioned indicating flanges.

Indirect illuminating means are provided for the indicators visible through the face plate, which means is constituted by a lighting chamber having a cover 43 extending over the entire width of the face plate. There is preferably enclosed within the chamber two or more incandescent lamps which are connected in parallel.

In operation, as above mentioned the upper compass rose or flange 18 indicates an intended or desired course as set by hand, and the lower rose indicates the actual or true course. Consequently the two compass roses are in line only if the desired and actual courses coincide. Assuming that automatic rudder control means are operatively connected to the bolometers 25, the actual course rose constantly follows the desired course rose. If the pilot intends to make a turn he angularly shifts the desired course rose by means of crank 19. The speed of the turn determines the radius of curvature thereof. For each curved path of the particular plane there corresponds an optimum angle of bank. During the curve the vertical axis of the plane should coincide with the apparent vertical. As the inclinometer indicates the direction of the apparent vertical, the ball 40 must remain during the curved flight between the marks 41. If the ball 40 departs from this position the plane will not be in a correct attitude because of an improper angle of bank. When the crank 19 is turned the plane goes into a bank and the rudder is simultaneously adjusted for the turn. If the crank is turned too quickly, the change of course will be too rapid which can cause a side-slip and creates a possibility of a nose dive. This danger accompanying a too rapid course change is brought to the attention of the pilot by the inclinometer ball 40 which will move beyond its central position indicating that the angle of bank is less than the angle between the true and apparent vertical. Thus the pilot will know whether or not the crank 19 is turned at the proper speed and he will know if the flight path is curved too sharply. To produce the proper banking angle which is correct for the particular curved flight path, in which ball 40 assumes a central position between marks 41, the pilot either must turn the crank 19 slowly or by actuating the ailerons must increase the angle of bank or transverse inclination.

There is thus provided novel means for controlling the attitude of an aircraft when, for example, in curved flight or when changing from one course to another. The device aids in a smoother, safer and hence a better steering control when making a turn. It is, furthermore, compact and light and well adapted for use in aircraft.

Although only one embodiment of the present invention has been illustrated and described in detail it is to be expressly understood that the invention is not limited thereto. For example, a window instead of having a rectangular shape, as shown in the drawing, can be oval. Also, instead of indirectly lighting the indicating flanges, as shown in Fig. 2 it is possible to dispense with the incandescent lamps and employ luminous paint upon said flanges. Various changes may be made in the design and arrangement of the parts without departing from the spirit and scope of the invention as the same will now be understood by those skilled in the art. For a definition of the limits of the invention, reference will be had primarily to the appended claims.

HEINRICH ROLAND.

PUBLISHED

APRIL 27, 1943.

BY A. P. C.

H. ROLAND

COURSE INDICATOR DEVICE

Filed Oct. 7, 1939

Serial No.

298,514

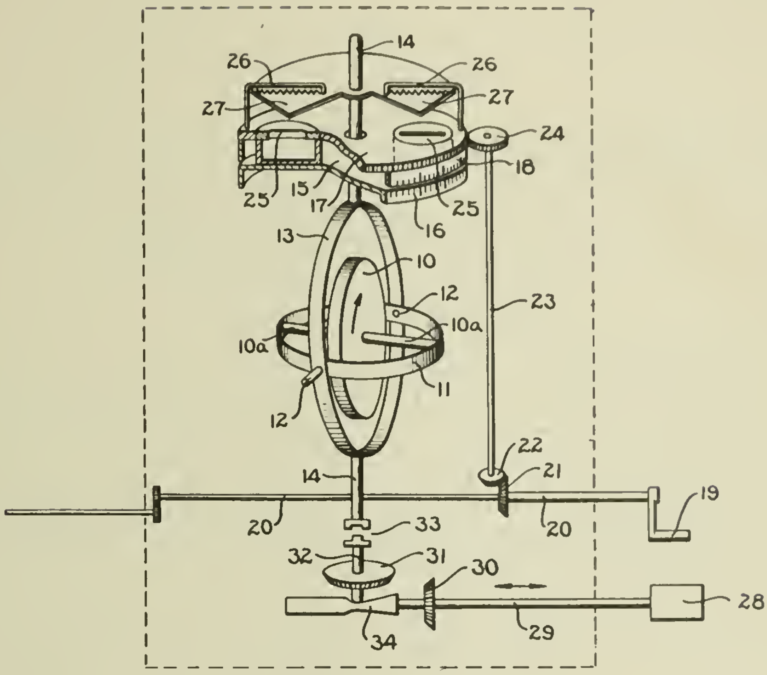

Fig 1

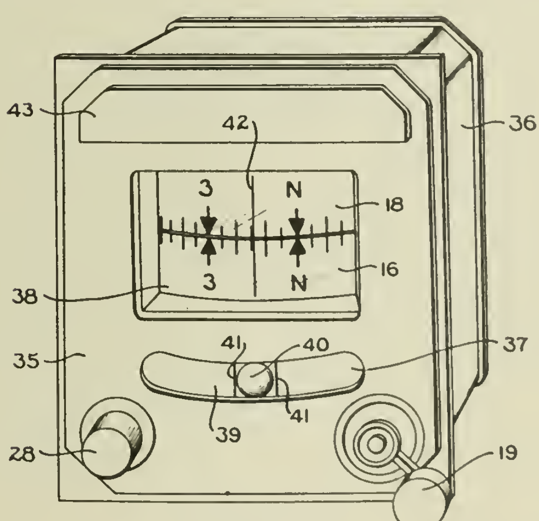

Fig 2

INVENTOR.

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Stephen Cerstvik

ATTORNEY.

Published Apr. 27, 1943

Serial No. 299,777

ALIEN PROPERTY CUSTODIAN

METHOD FOR BLEACHING CELLULOSE

Erich Knopf, Berlin, Germany; vested in the Alien Property Custodian

Application filed October 16, 1939

The invention concerns a method for bleaching cellulose. The letters patent protects in such a method the purpose of pumping the material to be treated with a pump through an injector, whereby owing to the underpressure caused in the nozzle by the action of pumping chlorine is aspired and immediately brought in direct contact with the cellulose by the eddy-currents before and within the diffusor of the injector.

Such a method intends to dissolve the largest possible quantities of chlorine gas in the material if one pumps the mixture of cellulose and water in the form of one single jet into the injector a relatively considerable dissolution of chlorine gas takes place. Owing to the flow and eddy-currents a thorough mixture is attained causing the chlorine to be quickly and extensively absorbed by the cellulose and this process proceeds so rapidly that the chlorine does not find time enough to oxidise the cellulose itself. Only a chlorination of the lignine takes place.

The present invention concerns an improvement or further development of the fundamental idea of the invention. The effect according to the fundamental invention is to be increased by dispersing the material to be treated into several jets in an injector, this effect being attained by supplying the material in the injector under pressure and by aspiring or pressing the chlorine gas (delivered in this way to the injector) in the intervening spaces between the jets.

A means of performing the method according to the invention consists for example in using an injector with several nozzle-exit-openings for the egress of the material to be dispersed radioformly into several jets. Of course also several nozzles can be arranged in the injector. But it is advisable to use a single-nozzle tube and to install a distributing mouthpiece with several openings at its end. The openings in the mouthpiece may be given different shapes.

By the method and the device according to the invention the jet-surface, whose effect is an aspiring one, is partly brought to a multiple of the surface of the single jet, whereas on the other hand the chlorine gas has the possibility of penetrating between the different jets and of mixing itself intimately with the cellulose. All the different jets enter the diffusor of the injector together with the aspired quantity of chlorine gas, the latter being as usual of a circular section. In the diffusor the different jets are again united. As already mentioned the intensive whirling movement of the mixture of the material and the water in the diffusor provides a thorough mixing-up of the aspired chlorine gas with the mixture of cellulose and water.

The drawing shows a form of the device according to the invention.

Fig. 1 shows a form of the injector according to the invention in section.

Figs. 2 and 3 show two different forms of the mouth-piece in plane projection.

One sees a nozzle-tube 1 which is closed by a disturbing mouthpiece with several openings 2. The distributing mouthpiece or the openings in it can have the shape to be seen in Figs. 2 and 3. Chlorine gas is pumped into an aspiration chamber 3 and thrown with the projecting jet into the diffusor 4, where it is distributed between the jets and owing to the intimate mixture completely dissolved.

ERICH KNOPF.

PUBLISHED	E. KNOPF	Serial No.
APRIL 27, 1943.	METHOD FOR BLEACHING CELLULOSE	299,777
BY A. P. C.	Filed Oct. 16, 1939	

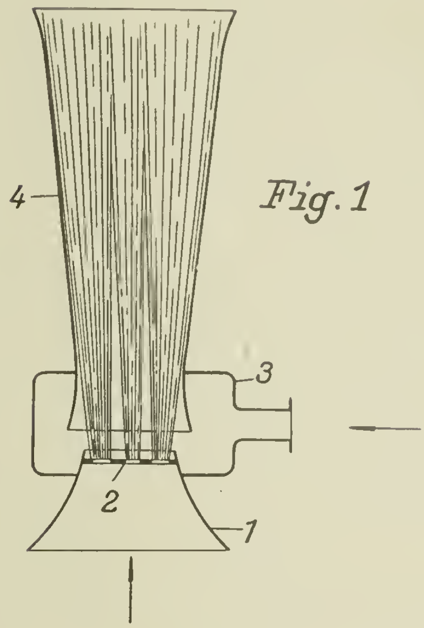

Fig. 1

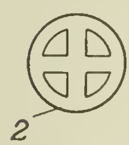

Fig. 2

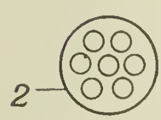

Fig. 3

Inventor:
Erich Knopf,
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Published Apr. 27, 1943

Serial No. 299,781

ALIEN PROPERTY CUSTODIAN

LINOLEUM COVERING FOR FLOORS

Raffaele Amendola, Milano, Italy; vested in the Alien Property Custodian

No Drawing. Application filed October 16, 1939

The present invention is related to linoleum floor coverings, of varied size and shape, constituted of a sheet of linoleum without the fabric layer foundation and it is intended to be enclosed by plunging its inferior face into the fluid cement interlayer cast between the covering and the floor to be covered.

In order to reach the bonding between the linoleum covering and the cement, the floor covering according to the present invention presents the inferior face, that is the face contacting the cement interlayer provided with projecting prominence or ribs. These prominences or ribs may show a biased cut such as a dovetail or any other suitable omologous shape and can stand forth more or less according to the thickness of the covering.

The floor covering according to the present invention constitute an improvement of the linoleum flooring, because it keeps all the most remarkable peculiarities of such flooring, is cheaper, offers a greater field of employment and remains anchored permanently to the floor.

It is known that the linoleum coverings now on the market are of different forms and sizes, for instance they are manufactured in long rolls of given width, in small or large plates, a. s. o., and are made up of a superior part of linoleum and of an inferior part of fabric, which are united during the calendering operations, that is during the operation in which the kneaded mass of linoleum is pressed to in order to adhere to the fabric foundation. In the linoleum industry found large appliance the jute fabric, which showed to be very suitable.

Such floor coverings are put on place coating the floor with an appropriate mastic or adhesive, by means of which is obtained the sticking of the covering to the floor which generally consists of a platform of cement or plaster.

Many factors can weaken the adhesive power of the binding agent, for instance the humidity or the crystallisation of the adhesive, so far as to loosen the covering from the floor and therefore in some case to come to be questionable the possibility of the use of such coverings in open spaces or in rooms having a great traffic, where hygienics requires very often the cleaning of the floor with plenty of water. Furthermore one has to bear in mind that, considering the influence of humidity on the binding agent, generally is preferred to await for the drying and seasoning of the floor before the covering can be applied to it, so that a long period of time elapses between the casting f. inst. of the reinforced concrete floor and the applying of the covering.

The linoleum coverings according the present invention are anchored to the floor by mechanical means without the employement of adhesives, i. e. by plunging the prominences or ribs of its inferior face into the fluid cement, which by the hardening seizes, permanently the prominences into its mass, so that all the possible troubles coming from the employement of adhesives are eliminated. It follows that the linoleum covering according to the present invention can be applied with complete confidence in all the cases in which the unfavourable conditions cannot assure a durable binding of the covering to the floor or the covering of the floor has to be done without any delay. Furthermore on account of the missing fabric base the coverings according to the present invention are particularly advantageous because they are cheaper, for they eliminate the employement of a material such as the jute, which is expensive and of not easy supply, and therefore exerting an influence on the price of the finished product.

According to the present invention the prominences or ribs on one of the faces of the linoleum sheet may be of any shape and size and can be obtained on the linoleum sheet either during the calendering or later by means of any suitable method.

In a preferred process the prominences on one face of the linoleum sheet are produced by means of a coarse mesh fabric, treated with known anti-adhesives, which is pressed in contact with the linoleum sheet during the calendering operation: the kneated mass of linoleum through the action of the pressure and of the heat penetrates into the meshes of the fabric, which later on is teared off leaving on the surface of the linoleum sheet a net of small groves. The fabric employed for this purpose results very useful because besides the forming of the prominences, it acts as a support during the manufacturing operations and the seasoning of the kneated mass of linoleum. The anchoring capacity of the linoleum sheet is not diminished if some of the prominences are broken away during the tearing off of the fabric.

The manufacture of linoleum according to the present invention can be carried on steadily, for inst. producing long strips, or with interruptions as in the case of the manufacture of small or large plates. After being teared off from the linoleum strip the coarse mesh fabric can be employed anew, increasing so the cheapness and the simplicity of the manufacturing process.

According another process the grooves can be obtained by means of an appropriate tool to chip one face of the finished linoleum sheet.

It is well understood that the processes as above do not limitate the invention. This invention relates to a covering for floors, socles, steps of a stair, a. s. o. of any form and size and consists of a linoleum sheet applied to the surface to be covered by means of the aforesaid prominences or ribs of dovetail section plunged into the liquid cement, with which the floor is coated.

RAFFAELE AMENDOLA.

Published Apr. 27, 1943

Serial No. 300,195

ALIEN PROPERTY CUSTODIAN

AUTOMATIC FIREARMS

Josef Koucky, Brno, Bohemia; vested in the Alien Property Custodian

Application filed October 19, 1939

The present invention relates to automatic firearms and more particularly to automatic hand firearms, especially pistols.

It is an object of this invention to provide for such automatic firearms, which have a diminished rapidity of fire.

Other objects will appear as the specification proceeds.

With automatic hand firearms and more particularly with pistols it is of importance that the rapidity of fire (cadence) is as small as possible, since with a high speed of fire the user has not sufficient time of accurately aiming afresh, so that the fire becomes very inaccurate. With automatic arms, for instance with machine guns, the rapidity of fire can be diminished by special devices which are mounted in the trigger mechanism. Such known devices are however very complicated and subject to disturbances with respect to the springs employed. In addition thereto it was not possible to use such devices in connection with small hand firearms such as pistols or the like.

The present invention purports to provide a device for diminishing the rapidity of fire, which can be used also with small arms of this kind and which is very simple so that the present constructions retain the properties required and more particularly the ease of operation.

According to the invention a considerable diminution of the rapidity of fire is attained by increasing the mass of the breech block by an additional mass, which is freely added to the breech block and is driven by same in either motion of direction, this additional mass acting by its force of inertia upon the driving momenta exerted on the breech block, no matter whether these driving momenta result from the action of the driving gases or from the tension of the recuperator spring. The additional mass forms a body which is so arranged with respect to the breech block or piece that this body after the end of the rearward and forward movement, respectively, of the breech block, by which it is driven, performs its relative motion to the breech block and strikes during this motion against the breech block, thus effecting a delay of the rearward and forward movement, respectively. The arrangement of the additional mass is preferably performed in such manner that the mass is accommodated between guide parts of the breech block which are connected with each other by a peg. The additional mass may for instance form a displaceable ring sliding on such a peg so that said guide parts form stops, which are distanced from each other by an amount greater than the breadth of the ring-shaped body, which thus performs a greater rearward and forward movement than does the breech block. By the arrangement of the additional mass on the moving breech block one obtains the qualities required, without a special delaying device being needed in the trigger mechanism or in the casing of the weapon. The arrangement according to the invention is simple, it does not require any springs and it is not subject to any disturbances so that the firearm secures accuracy of fire.

In the drawings affixed to this specification and forming part thereof an embodiment of this invention, applied to a pistol, is illustrated diagrammatically by way of example.

In the drawings

Fig. 1 is a sectional view of a pistol provided with a device according to the invention and with the breech device in opened position.

Fig. 2 is a partial sectional view, on a larger scale, of the pistol with the breech device in closed position.

Referring to the drawings, 1 is the casing of the breech, 2 the barrel and 3 the butt end of the pistol. In the wall of the casing 1 is arranged in known way an opening 4 for the ejection of the empty cartridge cases and a bearing for the magazine 5 of the cartridges 18. The cartridge chamber 6 of the barrel 2 can be closed by means of the breech block 7 which is provided with the striker 17 and the cartridge ejector 16. In the modification shown in the drawings the breech block consists of two cylindrical heads 8 and 10 which are connected by a peg 9. Between the two heads 8 and 10, which simultaneously serve as guide parts of the breech block, a ring 11 is arranged, by means of a bore, sliding on the peg 9. The breadth of this ring 11 is smaller than the distance between the heads 8 and 10, so that the ring which forms the additional mass provided in accordance with the invention, is capable of performing a relative motion with regard to the heads 10 and 8, respectively, to the amount x.

In the casing 1 is further accommodated the recuperator spring 12 of the breech device, which is arranged concentrically with the recuperator rod 14, and a trigger device 15 of any known construction.

When a shot is fired, the breech block is situated in the position shown in Fig. 2. By the return pressure of the gases of the powder charge in the cartridge the breech starts its rearward movement, guided by the heads 8 and 10 in the

casing 1 of the firearm, and compresses the recuperator spring 12. The ring 11 is placed during this motion close to the head 8 and is driven by same. After the end of the rearward movement during which the empty cartridge case is ejected through the opening 4, the breech block stops in the rearward return point, while ring 11 in consequence of the force of inertia performs a relative motion towards the head 10 by the amount x and strikes against head 10, as shown in Fig. 1. This blow acting against the action of the spring 12 causes a delay of the forward movement caused by the tension of spring 12. After the blow has been damped, the breech block starts the forward movement and simultaneously drives the ring 11 supported against the head 10. During the forward movement a fresh cartridge is pushed from the magazine 5 into the cartridge chamber 6, and another shot is fired in known manner, after chamber 6 has been closed. As soon as the breech block arrives at the forward return point, the ring 11 moves in consequence of the inertia towards the head 8 and acts now by another blow against the direction of opening of the breech block so that the opening is delayed.

By the action of the ring 11 on the heads 8 and 10, as described, one obtains a considerable decrease of the rapidity of fire (cadence).

In the example described above and illustrated in the drawing the breech block is shaped as a body of rotation and the additional mass as a ring-shaped body. The form of the body 11 and its arrangement on the breech block is however not decisive for the essence of the present invention, so that within the scope of the present invention the form imparted to the additional mass and its arrangement may be changed in various respects.

I wish it to be understood that I do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

JOSEF KOUCKY.

PUBLISHED

APRIL 27, 1943.

BY A. P. C.

J. KOUCKÝ

AUTOMATIC FIREARMS

Filed Oct. 19, 1939

Serial No.

300,195

Fig.1

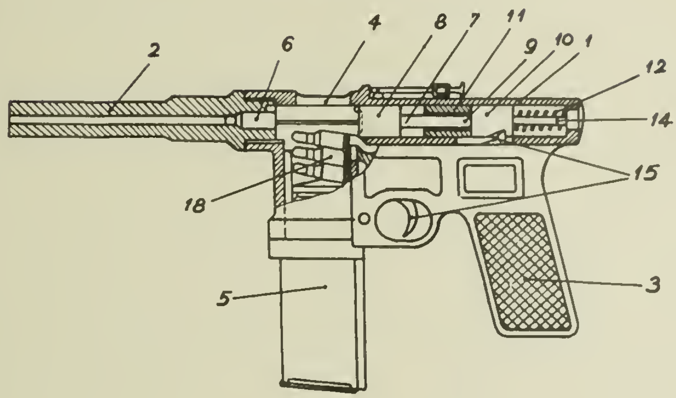
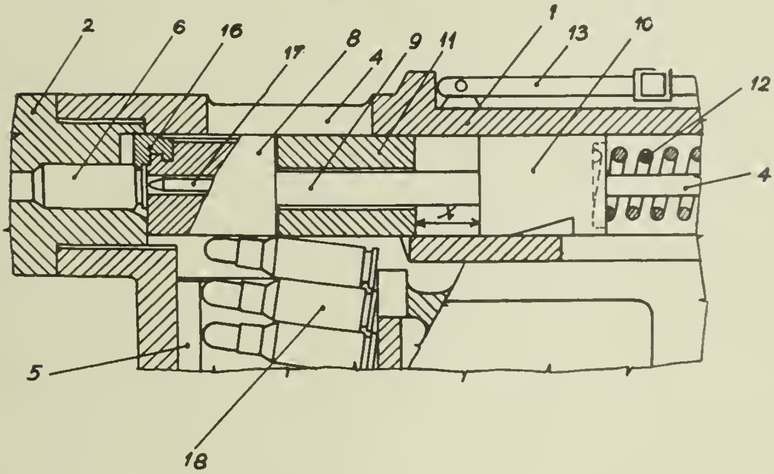


Fig.2



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Published Apr. 27, 1943 Serial No. 301,162

ALIEN PROPERTY CUSTODIAN

PRODUCING INJECTION-MOULDED ARTICLES

Heinrich Hopff and Hanns Ufer, Ludwigshafen-on-Rhine, Germany; vested in the Alien Property Custodian

No Drawing. Application filed October 25, 1939

The present invention relates to improvements in producing injection-moulded articles.

It is well known that for the manufacture of threads, ribbons and films there are excellently suitable "superpolyamides", i. e. highly condensed polyamides of practically linear molecular structure similar to polypeptides. These superpolyamides are obtained, for example, by heating aminocarboxylic acids by themselves or by heating dicarboxylic acids with diamines at higher temperatures until condensation products are formed which in the fused state can be drawn out to threads. Since the superpolyamides usually have a sharply defined melting point, they may also be used for the preparation of mouldings by the casting method. They may further be worked by the injection moulding method but the mouldings so obtained are unsatisfactory as regards their mechanical properties both when moulded or cast.

We have now found that mouldings having good mechanical properties can be prepared from superpolyamides according to the injection-moulding process by using the superpolyamides in a pre-orientated condition and injection-moulding them at temperatures below their melting point.

The orientation of the molecules of the superpolyamides may be effected in known manner, for example by extruding the molten superpolyamides through narrow orifices, slits or nozzles. Ribbons, foils, threads or tubes are thereby obtained. They are preferably stretched, if desired, at decreasing temperature. A sufficient orientation may also be obtained by rolling the superpolyamides on friction rollers.

The superpolyamides pre-orientated may then be comminuted in suitable apparatus, as beating mills, crushers or similar means and then be filled into the injection-moulding machine.

Care must be taken that the mass does not completely fuse in the injection cylinder; i. e. the operation must be performed below the melting point of the superpolyamides. Temperatures up to 40° C, preferably of between 10° and 35°, below the melting point of the superpolyamides have proved of particular advantage. The lower limit in the said range of temperatures is defined by the temperature at which the particles of the material to be injection-moulded only just coalesce thus forming homogeneous articles. This lower limit of temperature generally lies about 60° C below the melting point of the superpolyamides. Mouldings having particularly good mechanical properties are obtained within a relatively narrow range of temperature.

Preferably the orientated mass, while being injected into the moulds, is further kept strongly orientated for example by passing the mass, prior to entering the mould, through especially long narrow channels which may be heated to avoid excessive cooling of the mass, or through especially narrow nozzles, i. e. nozzles having less than 2 mm in diameter.

The mechanical properties of the superpolyamides are not only a function of the nature of the initial materials used, but also to some extent of the manufacture of the superpolyamides. Those superpolyamides have the best mechanical properties which have been prepared for example by condensing diamines with dicarboxylic acids or aminocarboxylic acids in a first stage in a closed vessel or in an open vessel under reflux of the water formed during the first stages of the condensation. The injection-moulded articles obtained from superpolyamides prepared in this manner are practically non-brittle and distinguished by a particularly high elasticity.

The masses to be injection-moulded may contain softeners and/or fillers, for example talcum, glimmer, graphite, asbestos, metal powder and the like. There may also be used superpolyamides of differing colors or mixtures of colored and uncolored superpolyamides, in order to produce mouldings of marbled appearance.

The mouldings obtained are distinguished by a high tensile strength and elasticity as well as by very smooth surfaces. They resist water and heat well and possess a good shape stability and a good electrical insulating power.

The following Example serves to illustrate how the present invention may be carried out in practice, but the invention is not restricted to this Example. The parts are by weight.

Example

A superpolyamide obtained by heating 100 parts of hexamethylenediamine adipic acid salt in a pressure-tight vessel at 280° C for 90 minutes in the presence of nitrogen, gradually releasing the pressure and again heating for about 4 hours at the same temperature under atmospheric pressure is pressed out from the reaction vessel through a rectangular slit of 5 mm in height and 50 mm in length (mounted on the bottom of the vessel) by pressing nitrogen into the vessel. The material when leaving the slit is stretched to twice its length and cooled with water. A long, thin, colorless, very tough, elastic band is thus obtained. The mass melts at about 250° C. It is reduced in a beating mill to about pea-size and worked in a usual injection-moulding machine having nozzles of from 1 to 2 mm in diameter at from 210 to 230° C. The mouldings thus obtained have a high tensile strength and elasticity and a beautiful smooth surface.

HEINRICH HOPFF.
HANNS UFER.

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Published Apr. 27, 1943 Serial No. 301,175

ALIEN PROPERTY CUSTODIAN

MANUFACTURE OF RECORDS ESPECIALLY SOUND RECORDING RECORDS FROM VINYLPOLYMERS

Wilhelm Wehr, Eilenburg, Germany; vested in the Alien Property Custodian

No Drawing. Application filed October 25, 1939

The use of vinylpolymers for the manufacturing of records, for recording as well as reproducing sound, is very well known. The physical qualities of most of the polymers make it necessary to obtain plasticity, required for correct registration of sound waves with the aid of a record cutter, by adding as swelling agents well known substances. The noted tendency of vinylpolymers, to hold back rests of the solvent and to gradually release them during storing, comprises the disadvantage that the surface qualities of the foils are subdue to a continuous uncontrollable change making distortions of sound-track and sound-reproduction inevitable.

One undertook therefore the forming of vinylpolymers into foils or sheets by heat only, with or without applying pressure simultaneously. In order to accomplish the necessary even distribution of the plasticizer in the foils of the vinylpolymers, an intense, repeated rolling process could not be avoided. During this process an occasional tearing off of finest metal splinters was inevitable. Although these minute splinters do not impede many practical appliances of the foils, they damage the stylus when using the records for sound registering purposes and this again causes an impure sound reproduction. It is however possible to form in a thermoplastic way plasticizer - containing foils from vinylpolymers, which show the even softness and elasticity of a surface, needed for sound cutting- and recording purposes, if the uniform distribution of the plasticizer is accomplished prior to the plastic process. It was proposed therefore to add plasticizers to the emulsion of vinylpolymers obtained from the polymerisation of emulgated monomers, before or during this polymerisation, in order to give useful qualities to the polymers, which in this case are coagulated from the emulsions by salt solutions. It was known also that watery emulsions of polymers, being free from plasticizers, were easily precipitated by organic liquids e. g. solvents, especially by alcohols.

The progress in emulsion technique lead to an increase in emulsion-stability of vinylpolymers to such an extent that plasticizers could be stirred without coagulation into the emulsions of a polymer. The improvement in emulsion-stability towards plasticizers caused in the meantime a considerably increased stability towards aliphatic alcohols. To work up these plasticizer-containing emulsions, salt solutions, especially aluminium salts were added. In applying salts a special careful washing process of the resulting coagulate was necessary, in order to avoid disturbances later on. But the extensive washing together with the not negligible energy to be applied, when stirring the plasticizers into the emulsions, had increased the total cost of the process considerably, without any security that all salt particles, especially from the harder portions were removed completely.

It was however discovered that an electrolytic coagulation was not necessary and that an even distribution of the plasticizer in the coagulate without intense prior emulsifying could be effected, if the emulsions of polymers or interpolymers of the vinyl-group were coagulated with a mixture of plasticizer and aliphatic alcohols. Such a mixture, the corresponding quantities of which are balanced according to the applied plasticizer and alcohol, coagulates the emulsion immediately. The coagulate contains the plasticizer evenly distributed, so that the rolling process is limited to the forming into foils only.

The following examples are an illustration of the invention whereby a polyvinylchloride-emulsion serves as representative of emulsions of polymers and interpolymers of the vinyl-group.

Example I

To 100 g. polyvinylchloride-emulsion (25%) are added 100 g. ethyl acohol (94%). After about 24 hours the emulsion has thickened very much without showing any coagulation. If into 100 g. polyvinylchloride-emulsion, prior filtered for the removing of coarse impurities, 10 g. tricresylphosphate are stirred by using a quick rotating stirrer, a plasticizer-containing emulsion is obtained which is stable for days. If however 100 g. polyvinylchloride-emulsion is mixed with 10 g. tricresylphosphate in 50 g. ethyl alcohol (94%), after two minutes already, a complete coagulation takes place. The coagulate contains the plasticizer uniformly distributed. It is sufficient to remove the adhering mother liquor by washing once. After drying the coagulate is formed into foils in the usual manner between 120–150° C hot rolls, in order to be pressed onto a plasticizer-free layer of polyvinylchloride and to be used as sound-recording record. The records obtained in this way show an even elasticity all over and the material does not tear off. It can be cut uniformly on its whole surface. A distortion of the track and the sound during reproduction is thus avoided to a very great extent.

Example II

100 g. emulsion according to Example I are treated with a solution of 5 g. phtalicaciddibutyl-

ester in 50 g. ethyl alcohol. This mixture coagulates after about 20 minutes. The coagulate is worked up according to Example I. If the phtalicacid-ester by itself only is stirred into the emulsion, a mixed emulsion of polyvinylchloride and plasticizer forms, which is stable for days.

Example III

100 g. of the emulsion according to Example I are treated with 10 g. ethyl alcohol. A coagulate has not started even after 48 hours. If however fonsäuremethylamid) are added to this alcoholic emulsion, coagulation begins immediately. The coagulate is worked into records in the same way as in Example I.

Example IV

100 g. of a 25% emulsion of an interpolymer of vinyl-chloride and acrylicacid-ester are mixed with a solution of 10 g. tripropylphosphate in 10 g. butanol. Coagulation forms immediately. The same quantity of emulsion mixed with the same quantity of butanol is still stable after several days.

The sound-recording record obtained in this way guarantees an even detrition of the stylus, so that a soft sound reproduction without disturbing ground noises is produced.

Instead of the ethyl alcohol, as described in the above examples, also methanol or propanol or mixtures thereof may be used. The proportion of plasticizers to alcohol quantities depends on the kind of plasticizer as well as on the alcohol and is different with emulsions of different polymers of interpolymers of the vinyl-group. In any case however the simultaneous application of plasticizer and aliphatic alcohol accelerates rapidly the coagulation of the emulsion.

WILHELM WEHR.

Published Apr. 27, 1943

Serial No. 302,452

ALIEN PROPERTY CUSTODIAN

METHOD AND DEVICE FOR CONSTRUCTING CONCRETE PILES MOULDED IN THE GROUND

Edgard Frankignoul, Brussels, Belgium; vested in the Alien Property Custodian

Application filed November 1, 1939

My invention relates to a method and device for constructing reinforced or non-reinforced concrete piles moulded in the ground by the aid of one or more preparatory tubes and has essentially for its object to utilize rationally, in the course of concreting the pile, the weight of the concrete poured into the preparatory tube, in order to increase the pressure of the concrete at the base of the said tube and to oppose efficiently the thrust from the earth that tends to cause a strangulation or even a shearing, of the pile shaft.

With this end in view and according to my invention, the feed of the concrete into the excavation previously formed in the ground by sinking one or more preparatory tubes is effected through the interior of an auxilary tube arranged with lateral play inside the preparatory tube, the said auxiliary tube having imparted to it quick longitudinal vibrations, so that the friction between the auxiliary tube and the concrete therein is practically annulled. The pressure at the base of the preparatory tube may be further increased by loading the concrete in the vibrating tube, for example with a rammer monkey or with compressed air pressure applied to the inside of the vibrating tube. In the further course of the method, the auxiliary tube, which is kept on vibrating, may be readily withdrawn in measure as the preparatory tube is being raised, while the concrete in the vibrating tube continues to exert the pressure at the base of the preparatory tube.

According to my invention, the vibrating tube preferably consists of a thin sheet metal tube extending with very small lateral play inside the preparatory tube and having imparted to it quick longitudinal vibrations, such as by means of one or more electric motors including an unbalanced weight and arranged on the vibrating tube, or by any other means. The vibrating tube may extend over the whole length of the preparatory tube or over a portion thereof and may have an outer flange or lug whereby to bear on the upper end of the preparatory tube, advantageously with a layer of elastic material interposed between the said lug and the said end.

As a result of the quick vibrations imparted to the auxiliary tube and which eliminate the friction between the latter tube and the concrete, a layer of substantially fluid cement paste is formed between the concrete and the said tube, which paste lubricates the latter and further facilitates the reciprocation and the withdrawal of the said auxiliary tube. Moreover and since the outer surface of the vibrating tube is free from any contact and, consequently, from any friction, it will be understood that the vibrating tube, which, in addition, may be of very little weight, can be vibrated at a very small expense of energy. Further, the vibrations are not transmitted to the surrounding ground, so that the danger of rendering the ground more mellow and thus increasing its tendency to cause strangulation of the pile is eliminated.

Owing to the design and arrangement of the vibrating tube, the means for producing the vibrations, such as the aforesaid electric motors including an unbalanced weight, may be provided at the upper end of the auxiliary tube and will nevertheless secure a perfect transmission of the vibrations over the whole length of the auxiliary tube.

Such results cannot be obtained by the known methods in which the preparatory tube is being imparted heavy blows or shocks such as by means of a steam hammer, the upwardly directed shocks being intended to cause every time the deposition of a certain quantity of concrete in the excavation formed by driving the preparatory tube, while the downward movements of the said tube serve to ram the concrete, preferably by means of an outer annular lug provided at the lower end of the tube. The said blows are applied at the relatively slow succession that may be obtained from a steam or pneumatic rammer (of the order of 60 to 200 blows per minute); the blows consequently act in a non continuous manner; they need be of great strength and great amplitude (several centimetres), since they are intended to overcome every time the friction between the preparatory tube and the concrete on the one hand, and between the said tube and the surrounding ground on the other hand, and since they serve for causing the progressive withdrawal of the preparatory tube and for effecting the ramming of the concrete. The principle of the known method is therefore essentially different from that of the present invention, since the old method does not eliminate the friction between the tube and the concrete, but overcomes such friction at every blow through applying to the preparatory tube an impulse which generates a force of inertia greater than that resulting from the friction between the concrete and the walls of the tube. Setting up shocks in the known method requires a high consumption of energy, which is due, among others, to the fact that the preparatory tube is necessarily heavy and that the frictional resistances to be overcome are very high. Moreover, the known method does not make it possible to ration-

ally oppose the pressure of the earth at the base of the preparatory tube, for the reason that the mass of concrete is not freed in a continuous manner from the tube, so that no advantage is taken from the weight of the concrete as far as opposing the continuous thrust from the earth is concerned.

In the method according to my invention, the friction between the concrete and the walls of the tube that contains it is invariably eliminated owing to the continuously acting high frequency vibration.

Simply by way of example, one way of carrying out the method of the invention will be hereinafter described with reference to the accompanying drawing, in which:

Fig. 1 is an axial section of a preparatory tube having associated therewith an inner vibrating tube, in the course of concreting a vertical foundation pile, and

Figs. 2, 3 and 4 are fragmentary sectional views showing three alternative embodiments of the vibrating tube.

The preparatory tube 1 is driven into the ground up to the desired depth in any convenient way. Thereupon, an enlarged footing 2 may be formed by ramming the concrete with the monkey 3. After the footing has been concreted and prior to starting with the concreting in accordance with the new method, a portion of the pile shaft may be formed by the known method of ramming concrete in the ground. If desired, a reinforcement 4 may be placed in the tube and have its lower end anchored in the concrete.

The tube 1 has arranged therein with small lateral play (for instance about ten millimetres) an auxiliary tube 5 made from thin sheet metal and having its upper end extending up to a point above the upper end of the tube 1, while its lower end extends up to the proximity of the lower end of the said tube 1. The tube 5 is provided with means 6, 7 for imparting thereto quick vertical vibrations, which means may consist of a small pneumatic monkey or of one or more electric vibrators secured in any way to the vibrating tube.

To effect the concreting of the pile, a quantity of concrete 9 is charged into the auxiliary tube 5, preferably so as to fill up the latter, and may even correspond to the amount of concrete necessary for constructing the whole of the pile. Use may be made of relatively moist concrete such as would readily ensure a perfect encasing of the reinforcement. The tube 5 has then imparted to it quick vertical vibrations of small amplitude, with the result that all adhesion between the tube 5 and the concrete 9 is eliminated, so that the latter in fact forms a free column the total weight of which acts at the base of the preparatory tube, i. e. upon the portion of pile already moulded in the ground, and opposes efficiently the thrust from the earth. Hence, the tube 5 may be moved without friction with respect to the concrete 9 and, consequently, may be readily raised. The raising may be effected by any convenient means, in measure as the preparatory tube 1 is withdrawn, which may be done for example by means of the usual cables. The tube 1, being not in contact with the concrete 9, can be withdrawn at a smaller consumption of energy than in the known methods.

The vibrations of the tube 5 are not intended to raise the latter; they are of equal amount in both directions and of very small amplitude, for instance, a few tenths of a millimetre, while their frequency should be very high, and, more specifically, sufficiently high—for example of the order of 1000 to 6000 per minute—for eliminating practically all friction between the concrete 9 and the tube 5.

The tube 5 may be inserted into the tube 1 after the latter has been driven to the desired depth and after the enlarged footing has been formed; alternately, the tube 5 may be placed in position before the driving action is started.

The tube 5 may be set in vibration as soon as the first batches of concrete are introduced; it may then be raised up to a certain height before the total quantity of concrete necessary for constructing the pile is poured into the tube. If desired, the head of concrete 9 may be subjected to a load during vibration, for example by placing thereon the monkey 3 or by applying compressed air. In the latter instance, the vibrating tube need be suitably maintained, for example secured to the preparatory tube, in order to prevent the vibrating tube from being driven upwards under the effect of the air pressure; moreover, the upper end of the vibrating tube will be provided with a particular cap enabling the supply of compressed air.

A lug 8 of the vibrating tube may be arranged to bear upon the upper edge of the tube 1, so that the tube 5 will be raised simultaneously with the tube 1. The transmission of vibrations to the tube 1 may be prevented by interposing a washer 10 (Fig. 2) of elastic material, such as rubber or cork, between the upper edge of the tube 1 and the lug 8. The washer may be centered in position by means of an annulus 11 the web 12 of which projects into the interior of the tube 1, thus preventing the vibrating tube 5 from shifting laterally.

As shown in Fig. 3, a certain number of saw notches 13 may be cut over a relatively short longitudinal distance in the lower end of the tube 5. The latter tube being made from thin sheet metal, the flaps provided by notching are resilient and would open out under the action of the pressure of the concrete, so that, when the tube 5 is withdrawn, the concrete progressively spreads out in the excavation formed during the driving of the preparatory tube. If desired, the said flaps may extend up to a point below the preparatory tube.

Alternately, and as shown in Fig. 4, the vibrating tube may have secured to its lower end resilient flaps 14 of slightly trapezoidal shape, said flaps partially overlapping each other and widening out in the downward direction, it is to say, towards their free ends. When the tube 5 is empty, the said flaps extend in alignment therewith; when the tube is filled with concrete, the flaps are capable of spreading out slightly in the same manner and with the same object as the flaps obtained by notching the lower end of the auxiliary tube. Owing to their shape however, the trapezoidal flaps will provide a sufficiently tight joint with each other, whatever be the amount of spread-out.

EDGARD FRANKIGNOUL.

PUBLISHED
APRIL 27, 1943.
BY A. P. C.

E. FRANKIGNOUL
METHOD AND DEVICE FOR CONSTRUCTING PILES
Filed Nov. 1, 1939

Serial No.
302,452

FIG. 1.

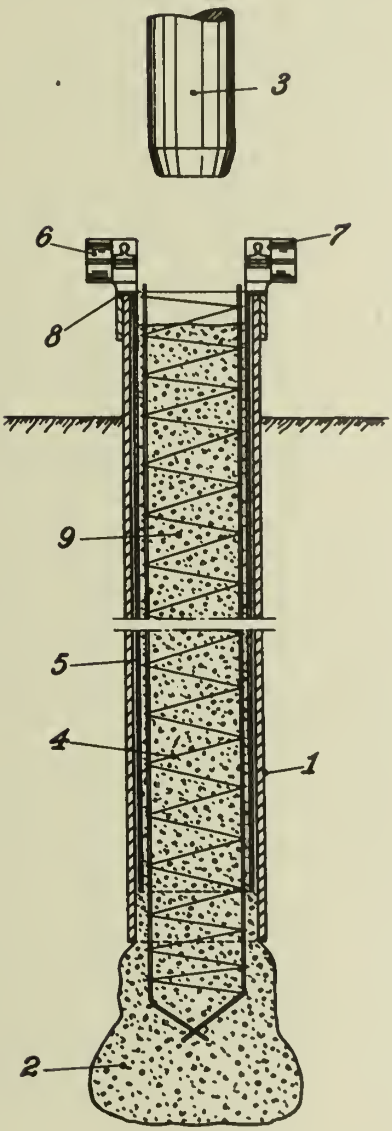


FIG. 2.

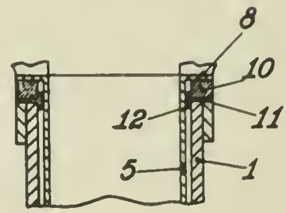


FIG. 3.

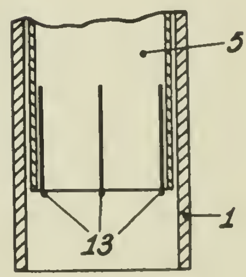
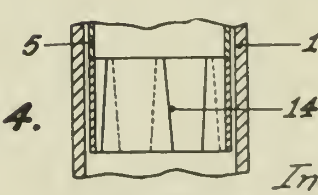


FIG. 4.



Inventor;
E. Frankignoul

by: Glascock Downing & Seebold
Attys.

Published Apr. 27, 1943 Serial No. 303,058

ALIEN PROPERTY CUSTODIAN

METHOD OF AND APPARATUS FOR PRODUCING GLASS FIBERS

Gedeon von Pazsiczky, Hamburg-Wandsbek, Germany; vested in the Alien Property Custodian

Application filed November 6, 1939

The present invention relates to a method of and apparatus for producing relatively fine fibers or filaments from molten glass, slag and other inorganic materials which are plastic when heated.

The principal object of the invention is to provide such a method and apparatus wherein creation and attenuation of the fibers is accomplished by the blowing force of a flame together with the products of combustion thereof.

Another object of the invention, in connection with a modified form of the invention is to provide a method and apparatus of this character in which the attenuation of the fibers is further augmented by centrifugal force.

The provision of an apparatus for producing glass fibers which is relatively simple in its construction, consisting as it does of a minimum number of moving parts, and which is therefore unlikely to get out of order, is another desirable feature that has been borne in mind in the production and development of the present invention.

Other objects of the invention, not at this time enumerated, will become apparent as the nature of the invention is better understood.

In the accompanying single sheet of drawings three embodiments of the invention are shown. In these drawings:

Fig. 1 is a longitudinal sectional view taken substantially centrally through a fiber-producing nozzle constructed according to the principles of the present invention;

Fig. 2 is a sectional view taken substantially centrally through a modified form of fiber-producing and ejecting apparatus; and

Fig. 3 is a sectional view similar to Fig. 2 showing another modified form of fiber-producing and ejecting apparatus.

Referring now to Fig. 1, a nozzle-like body **10** having an outlet **12** is formed with an integral flanged cylindrical portion **14** having a bore **16** that communicates with the bore **18** of the body **10**. Anchored in the bore **16** by a driven fit is an inner flame-producing burner including an elongated tubular fuel conducting member **20** through which there extends centrally an air conducting pipe or tube **22**. Gaseous fuel is introduced into the tubular member **20** from a connection **24** and is combined with the air passed through the tube **22** at a point near the outlet **12** of the body **10** to produce a flame within the latter member. Glass introduced into the body **10** through the bore **18** thereof is heated to a high degree by the flame issuing from the flame producing burner **20**, **22**, and is attenuated as it is forced from the outlet **12** into the form of fine fibers. Obviously the gaseous fuel and/or the air employed for producing the flame is maintained under relatively high pressure so that the flame and its products of combustion will have sufficient jet effect to properly create and attenuate the fibers issuing from the outlet **12**.

In Fig. 2 wherein a modified form of fiber-producing apparatus is shown, centrifugal force may be, but is not necessarily, utilized as an additional factor in the attenuation of the glass fibers. Toward this end, a substantially cylindrical and rotatable riser **30** in the form of a tube extends downwardly below the surface of the body of molten glass contained in a tank **32**. The glass is forced upwardly in the riser **30** by means of air pressure which is built up in the tank **32** by means of a blower **34**. The upper end of the riser **30** is formed with an opening **36** in one side thereof providing a weir **38** over which the molten glass is flung outwardly as the riser **30** rotates. A flame-producing burner **40** extends downwardly into the riser **30** and has its lower portion directed horizontally in close proximity to the level of glass in the riser **30** in such a manner that the flame strikes the body of glass and assists in forcing it over the weir **38**. The riser **30** is rotatably supported in bearings **42** and is formed with a series of teeth **44** providing in effect a sprocket wheel over which there passes a chain **46** by means of which the entire unit including the riser **30** and burner **40** may be rotated in unison. A combustible mixture of gases is supplied to the burner **40** by means of a flexible conduit **48** which is connected thereto by means of a slip union **50**.

In operation, the combustible mixture of gases is supplied to the burner **40** at relatively high pressure and the flame issuing from the burner assists the centrifugal force acting upon the glass in the vicinity of the weir **38** in creating and attenuating the glass fibers which are thrown laterally from the apparatus.

In Fig. 3, a tank **52** including a wall **54** of tapered cylindrical design, and a base portion **56** having a downwardly extending tubular portion **58** is rotatably mounted as a unit in bearing **60** carried by a stationary framework or supporting structure **62**. A series of openings **64** are formed in the wall **54** while a series of burners **66** threadedly received in the base portion **56** of the tank **52** extend into the openings **64** and terminate just within the confines of the tank. Gaseous fuel is conducted to the burners **66** through the

hollow tubular portion 58 and through radially extending bores 68 communicating therewith, while air is conducted to the nozzles through a central conduit 70 and radial branch conduits 72. Supply conduits 74 and 76 for the fuel gas and air respectively communicate through a conventional slip union 78 with the conduit 70 and the space surrounding the same.

A series of teeth 80 are formed on the tubular portion 58 and provide in effect a sprocket wheel over which there passes a chain 82 by means of which the tank 52, including the base portion 56 and its extension 58, as a unit is rotated.

The base portion of the tank 52 slopes outwardly and downwardly in all directions from a central apex 83 toward the openings 64. Thus it will be seen that molten glass issuing from a supply chute 84 and entering the tank 52 will flow downwardly and outwardly toward the openings 64 and will be forced through the latter and attenuated in part by the action of centrifugal force created by rotation of the tank 52 and in part by the force of the flame jets and their respective products of combustion issuing from the burners 66.

In each of the forms of the invention set forth above the character of the flame produced may be varied to vary the character of fibers issuing from the apparatus. If the combustible gaseous mixture or the individual components thereof is or are released at relatively low pressures, combustion will take place at or very near the burner tip so that attenuation of the fibers will be effected by the spent products of combustion at a relatively high temperature. If the pressure of the mixture or of one or more of the components thereof is increased, combustion will take place further away from the burner tip so that attenuation of the fibers will be effected by the blowing force of the mixture substantially as combustion occurs. On the other hand, if the pressure of the mixture or its components is very high, attenuation will be effected initially by the relatively colder mixture before combustion has occurred and subsequently the fibers thus produced will be enveloped by the flame in the region of combustion and will be further attenuated by the spent products of combustion. Regardless however of the specific manner in which the flame is applied to the molten glass, the essential features of the invention are at all times preserved.

The invention is not to be limited to the exact arrangement of parts shown in the various figures of the drawings or to the exact description of the same set forth above. Various changes in the details of construction are contemplated without departing from the spirit of the invention. For example, while I have described the various burners as being operable to produce a flame by means of a combustible mixture of a gaseous fuel and air, it is obvious that an oxy-hydrogen, an oxy-acetylene or other flame utilizing a mixture of combustible gases under a suitable pressure may be employed. Steam or air may also be provided to accelerate attenuation over the weir.

GEDEON von PAZSICZKY.

PUBLISHED

APRIL 27, 1943.

BY A. P. C.

G. VON PAZSICZKY
METHOD OF AND APPARATUS FOR
PRODUCING GLASS FIBERS
Filed Nov. 6, 1939

Serial No.
303,058

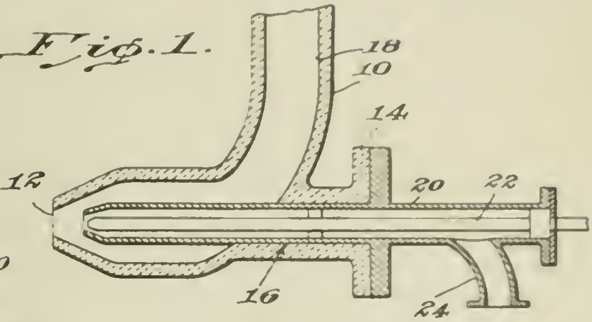


Fig. 1.

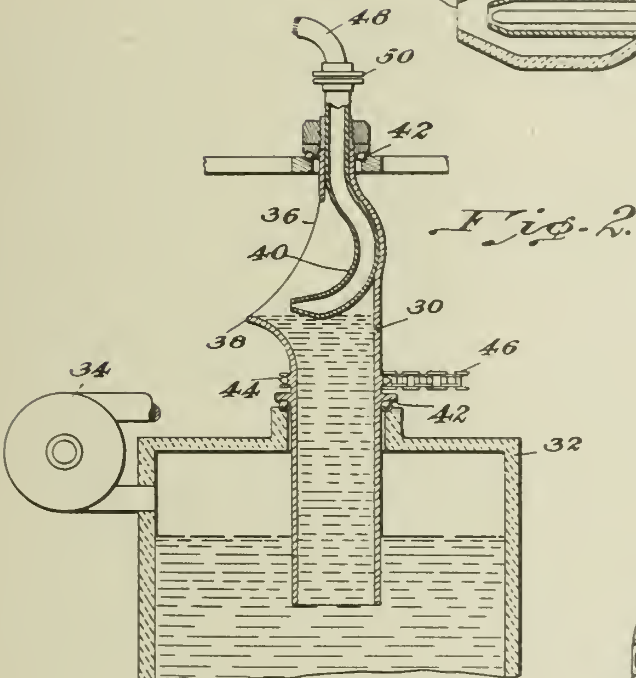


Fig. 2.

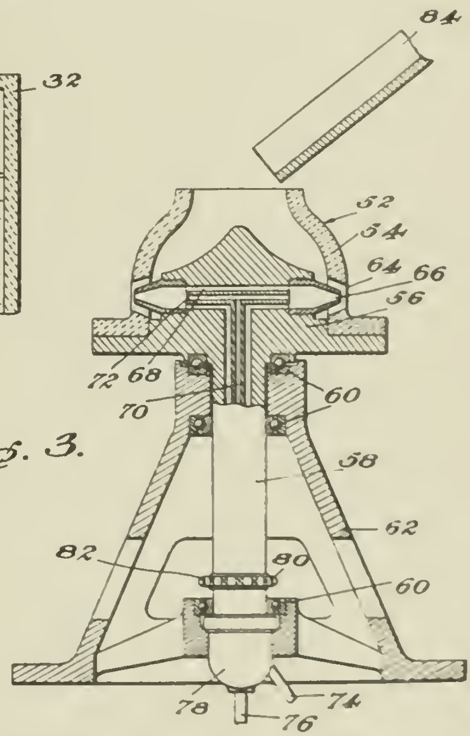


Fig. 3.

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Published Apr. 27, 1943

Serial No. 303,181

ALIEN PROPERTY CUSTODIAN

REFRIGERATING APPARATUS OF THE COMPRESSION

Rudolf Hintze, Berlin-Charlottenburg 9, Germany; vested in the Alien Property Custodian

Application filed November 7, 1939

The present invention relates to improvements in refrigerating apparatus of the compression type, and more particularly to a control therefor.

In my prior Patent No. 2,161,960, dated June 13, 1939, I have described a control mechanism for refrigerating apparatus of the compression type, whereby the flow of the refrigerant into the evaporator is rendered as uniform as possible. To this end, the refrigerant which is connected in a collecting tank flows to the evaporator through a valve which is spaced from the point where the collecting tank is located and which is controlled by a float in accordance with the liquid level of the refrigerant in the tank. The float then adjusts a resistance lying in the circuit of an electromagnet which serves to operate the control valve intermediate the collecting tank and the evaporator.

In the arrangement described in my prior patent, the electromagnet of the control valve is located at a point within the cooling chamber of the refrigerator and in the immediate vicinity of the evaporator. It has now been found that with such an arrangement of the electromagnet in the cooling chamber, the temperature therein will be increased to some extent since the electromagnet is excited continuously.

It is therefore the object of this invention to provide a refrigerating apparatus with an electromagnetically controlled valve of the type described above, in a manner so as to avoid a heating of the cooling chamber. For attaining this object, an arrangement may be provided in which the electromagnet of the control valve is located at a point outside of the cooling chamber. To this end, the entire valve mechanism, including the valve as such and the electromagnet for operating the same, may be arranged outside of the cooling chamber or, according to a preferred embodiment of the invention, the valve as such may be located within the cooling chamber and be adjusted by an electromagnet arranged outside of the cooling chamber by means of a valve piston or connecting rod extending through the refrigerator casing.

The accompanying drawing illustrates diagrammatically one embodiment of the present invention applied to a household refrigerator of the compression type.

Referring to the drawing, the refrigerator consists of a cooling chamber 1 underneath which are arranged the motor compressor set 2, the condenser 3, a ventilator 4 for circulating the cooling air, and a float tank 5. In the latter is placed a float 6 secured to an iron core 7. The iron core 7 cooperates with a coil 8 which is arranged about a socket 9 on the upper end of the float tank 5 at a point outside of the cooling system. The iron core 7 then moves within the socket 9 and the coil 8 in upward or downward direction, depending upon the liquid level of the condensate in the tank 5. The coil 8 lies in the circuit of an electromagnet 10 serving to operate a valve 11. The latter controls the flow of the liquid refrigerant into the evaporator 12 arranged in the upper part of the cooling chamber 1. The valve 11 comprises a valve rod 13 extending through the refrigerator casing and having secured to its outer end an armature 14. A tube 15, which serves for guiding the valve rod 13, extends at the inner end, that is, within the cooling chamber, into a valve chamber 16 which is connected with the condenser 3 through the conduit 17. The tube 15, which extends through the refrigerator casing, is provided on its outer end, that is, on the outside of the refrigerator casing, with a chamber 18 housing the armature 14 and carrying on its outside the coil 10. A compression spring 23 serves for holding the valve rod 13 normally in closing position. The vaporous refrigerant flows from the evaporator 12 through a conduit 19 back into the suction side of the compressor 2. The control circuit for the electromagnet 10 is connected to the alternating current supply circuit 21, 22 through a switch 20.

The above described arrangement operates as follows: Since as above described the iron core 7 is secured to the float 6, it moves within the coil 8 and the socket 9 in upward or downward direction depending upon the liquid level of the condensate in the tank 5. At a high liquid level the float 6 assumes the position shown in the drawing so that the resistance of the coil 8 is reduced to such an extent that the force of the electromagnet 10 is sufficient to open the valve 11 against the force of the compression spring 23. The valve 11 therefore permits the refrigerant to flow into the evaporator 12 through the conduit 17. Accordingly, the liquid level in the tank 5 lowers and the iron core 7 moves in downward direction. The increase in resistance of the coil 8 caused thereby, weakens the exciting current of the electromagnet 10 to such an extent that the valve 11 is again closed under the action of the compression spring 23.

RUDOLF HINTZE.

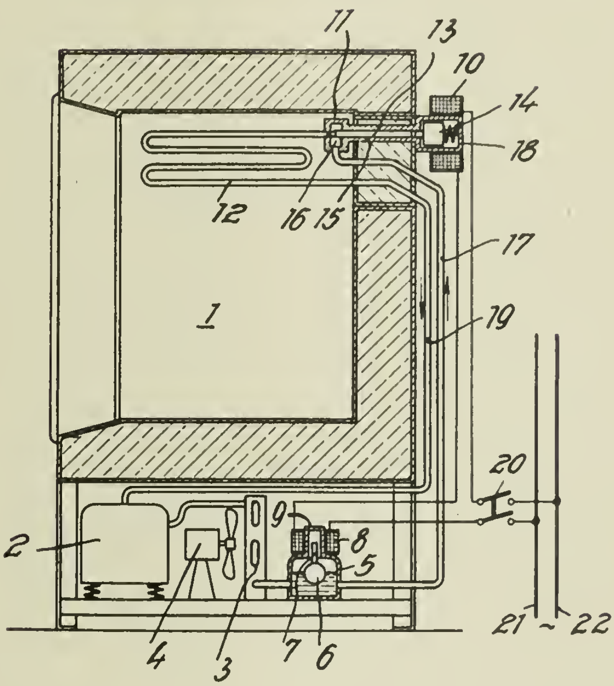
PUBLISHED

APRIL 27, 1943.

BY A. P. C.

R. HINTZE
REFRIGERATING APPARATUS OF
THE COMPRESSION TYPE
Filed Nov. 7, 1939

Serial No.
303,181



Rudolf Hintze
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Published Apr. 27, 1943

Serial No. 303,852

ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PRODUCTION OF A WATER GAS PARTICULARLY SUITABLE FOR SYNTHETIC PURPOSES

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Application filed November 10, 1939

This invention relates to a process for the production of a water gas particularly suitable for synthetic purposes.

The purpose of the process according to the invention is the production of water gas, in particular for synthetic purposes, by complete gasification by a continuous method, of liquid combustibles, such as mineral oils or their distillation residues, gas oils, tars of any origin and so on. According to the process of the invention the liquid combustibles are gasified with the application of a relatively small excess of steam, without the assistance of catalysts, at temperatures of above 1100° C, advantageously 1200–1300° C and at high pressures of more than 10 atmos., advantageously between 15 and 20 atmos.; the high reaction temperature is maintained by direct combustion by means of oxygen of a portion of the liquid combustible introduced into the reaction chamber.

Liquid combustibles were employed hitherto in gas production at the most for carburation of the water gas admixed with the town gas. It has indeed already been proposed to subject heavy oils at temperatures of 700–1100° C, at ordinary or reduced pressure or also with slight excess pressure, to a cracking operation and then to pass the cracking products for the purpose of their conversion into permanent gases, through likewise heated catalysts, as for example a catalysis chamber filled with metallic iron, metallic nickel, iron oxide, manganese dioxide and so on at a similar high temperature and for the purpose of maintaining the temperature to burn a portion of the oil in the cracking chamber; this proposal directed essentially to the production of oil gas has however not proved successful in practice, among other reasons because the catalysts employed tended to become sooted up.

A process which has been put into practice is also known for the production of a town gas rich in methane in the case of which the gasification is carried out with the application of high pressures of about 20 atmos. This process is however only directed to the gasification of solid combustibles, in particular such lignites from which a reactive coke can be produced; the pressure-tight reaction chamber is filled with granulated lignite of the described kind and into the lignite mass an oxygen-steam mixture is blown at a pressure of about 20 atmos, the temperature being maintained relatively low at about 750° C. The composition of the gas rich in methane produced in a continuous operation, after washing out the considerable quantities of carbon dioxide contained therein, corresponds substantially to the customary town gas composition.

Finally gas producers fed with oxygen with internal heating are known in which in a continuous operation coal dust is worked up. In these plants the gasification takes place at ordinary pressure with the application of a large excess of steam and at relatively low temperatures.

The purpose of the process according to the invention is to produce from liquid combustibles a gas intended in particular for synthetic purposes, the methane content of which amounts to less than 1%, that is to say which is practically free from methane, which also contains carbon dioxide in quite inconsiderable quantities and consists essentially of carbon monoxide and hydrogen. A particularly important feature of the process is the simultaneous application of high pressures and high temperatures. By these reaction conditions in fact the velocity of the reactions taking place is essentially increased. The application of the high pressure further allows of an essential reduction of the dimensions of the plant and a particularly favorable utilisation of the waste heat. It is to be recommended to adjust the pressure so high that the impurities contained in the crude gas (for example carbon dioxide and hydrogen sulphide) can be easily washed out with water. Also from the point of view of the carbon monoxide conversion which may be necessary according to the purpose of application of the gas, it is advantageous to work with previously compressed gas.

The application of high pressures appears to be in contradiction to that object of the process according to the invention according to which from the liquid combustibles a practically methane free gas is intended to be produced, since as is known in reactions which are linked up with a change of the number of the molecules, an increase of the pressure has for its result a displacement of the reaction in the direction of a reduction of the number of molecules. From the known equation of the methane equilibrium

$$CO+3H_2 \rightleftarrows CH_4+H_2O+48.9 \text{ Cal}$$

it is seen that by the increase of the pressure the reaction is displaced towards the right and thus the methane synthesis, that is to say a process undesired in accordance with the present invention, is favored. The methane formation is, however, in the process of the invention, restrained by the high temperatures employed; at temperatures in the neighborhood of 1100° C and

above, the gas contains in spite of the high pressure no noteworthy quantity of methane.

The requirement of the process of the invention as regards heat is provided for by combustion by means of oxygen of a corresponding portion of the liquid combustible atomised in the high pressure reaction chamber. The temperature of the reaction chamber which according to the invention should be at least about 1100° C, suitably, however, about 1200–1300° C, is adjusted according to the desired composition of the synthesis gases to be produced. In this case there is no need to discuss the otherwise known relations between temperature and gas composition. Obviously for the production of a gas always of the same composition the temperature in the reaction chamber must be maintained constant; any variations can be compensated by regulation of the oil, steam or oxygen supply without difficulty. The steam necessary for the water gas reaction is according to the invention employed in a slight excess, suitably such as is only a little above the theoretically necessary quantity. Accordingly the steam content of the crude gas leaving the gas producer is also very small, varying for example between 1 and 5%. The distillation residues, for example the masut advantageously applicable for the purpose of the process according to the invention usually contain several per cent of water, so that the quantity of the water contained in the liquid combustible must be accounted for in the water gas reaction.

With the high reaction temperatures employed in the process according to the invention the organic sulphur compounds contained in the liquid combustibles will be subject to decomposition under the action of the steam; the formed hydrogen sulphide can be easily removed subsequently, for instance by washing with water.

According to the process of the invention masut was gasified in an experimental plant, the temperature being maintained at 1200° C; the gas had the following composition expressed in volumes per cent

CO_2	0.5
CO	49.2
H_2	48.7
CH_4	0.4
H_2O	1.2

In the drawing is illustrated diagrammatically in section an example of an apparatus applicable for carrying out the process of the invention.

The reaction chamber 1 is surrounded by a pressure tight double walled boiler 2 including a water chamber, which boiler is provided in the interior with a heat resistant lining 3. The water chamber of the boiler is connected by the tubes 4 with the steam collecting drum 5. The liquid combustible passed through the tube 6 under high pressure enters into the reaction space 1 through the nozzles 7; immediately prior to its entry into the reaction space, to the liquid combustible through the tube 8 oxygen and through the tube 9 steam are supplied. A portion of the combustible burns with the oxygen in chamber 1 and here maintains the high temperature permanently; the lining 3 impedes losses of heat. With the quantity of heat which does, however, traverse the lining, in the boiler 2 low pressure steam is produced which is taken off through the tube 10 and can be usefully employed.

The hot gases passing out of the reaction chamber 1 under high pressure and streaming through the fire tubes 12 of the boiler 11 produce high pressure steam which by way of the connecting tubes 13 collects in the collecting drums 14 and streams through the collecting tube 15 to the superheater 16, then through the pipe line 17 to the place of employment. The quantity of the steam supplied to the mixing nozzles 7 through the tube 9 branched from the pipe 17 can be regulated by the valve 20.

The gases passed through the draught tubes of the boiler 11 pass through the channel 19 enclosing the steam super-heater 16 and the oil preheater 18 and then pass to purification devices not illustrated in the drawing.

It is to be recommended to introduce the liquid combustible into the reaction chamber in finely atomised form. A preferred method of carrying out the atomisation, which can, however, be effected in other ways, consists in that the liquid combustible for example masut is emulsified with some water and supplied to the atomiser in as far as possible preheated condition under high pressure for example at 80–100 atmos; the pressure is now suddenly reduced to that prevailing in the reaction chamber which is considerably lower, for example 20 atmos, whereby an extraordinarily fine atomisation of the oil is effected owing to the water emulsified therewith being immediately converted into steam.

Since according to the invention the complete gasification of the liquid combustibles takes place without the assistance of catalysts, obviously all the disadvantages inherent in the application of catalysts are avoided, such as their sooting up, the necessity for regeneration and so on. A further advantage of the gasification of liquid combustibles is due to the very low ash content of these combustibles, whereby difficulties of operation on account of slag formation are likewise avoided.

A further advantage consists in that the introduction of the liquid combustible into the reaction chamber can be easily and accurately regulated and accordingly also the requirements of oxygen and steam to be determined by preliminary experiments can be accurately adjusted whereby a uniform operation of the gas producer is rendered possible.

GÁBOR SZIGETH.

PUBLISHED

APRIL 27, 1943.

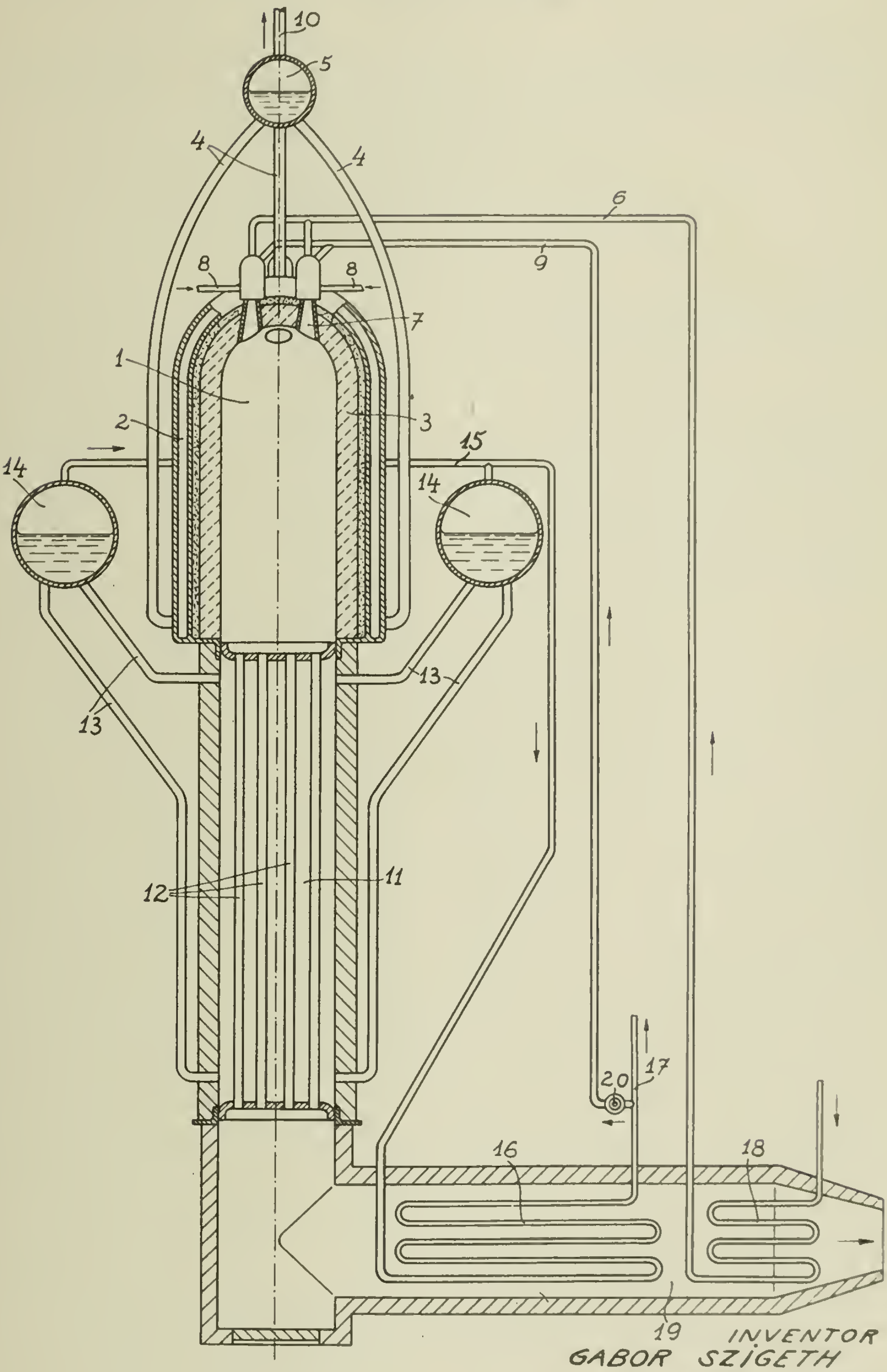
BY A. P. C.

G. SZIGETH

PROCESS FOR THE PRODUCTION OF A WATER GAS PARTICULARLY SUITABLE FOR SYNTHETIC PURPOSES

Filed Nov. 10, 1939

Serial No. 303,852



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GABOR SZIGETH
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Published Apr. 27, 1943

Serial No. 304,226

ALIEN PROPERTY CUSTODIAN

BREECH MECHANISM FOR AUTOMATIC FIREARMS

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Application filed November 13, 1939

This invention relates to automatic firearms of the kind wherein the bolt is operated by the cartridge shell recoiling under the pressure of the powder gases, after having overcome the inertia of the bolt, and wherein, in order to increase the inertia of the bolt and thus prevent premature opening of the same, the bolt comprises two members connected by a lever hereinafter referred to as an "inertia lever" having two arms of different lengths, the lever being pivoted on the bolt proper, its longer arm loosely connected to the inertia member of the bolt, the shorter arm engaging a stationary abutment in the breech casing of the arm, thus imparting, under pressure of the cartridge shell, to the inertia member relative movement at increased velocity.

The present invention comprises an improved construction of such bolt mechanism, according to which the two armed inertia lever, adapted for retaining without any additional component parts, itself and the two members of the bolt in their unlocked relative position during the recoil and return movement of the bolt, reduces at the same time the pressure and friction between the inertia lever and the breech casing, caused by the pressure of the closing spring.

The invention also comprises means for lessening friction between the moving parts, during their rearward and forward travel, and their guide, that is the breech casing, caused by the tendency of the return spring to rotate the inertia lever into its initial locked position, thus causing lateral pressures on the walls of the receiver. One embodiment of the invention is illustrated in the accompanying drawing, in which

Fig. 1 is a longitudinal section through the bolt in its closed position,

Fig. 2 is a longitudinal section through the bolt during its rearward movement,

Fig. 3 is a cross section through the straight guide of the bolt and through the abutment of the inertia lever,

Fig. 4 is a cross section, showing the seat of the handle in the striker.

The barrel 1 is firmly connected, by a screw-thread, to the breech casing 2 comprising a hollow cylinder, the rear of which is closed by a cap (not shown).

Behind the magazine and ejection openings, and close to them, an inverted U shaped part 6 sits on the breech casing, its flanges passing through the wall of the same and forming the straight guide for the bolt. Below this straight guide 6 is arranged in a cut in the lower wall of the breech casing the abutment 7 of the inertia lever. The straight guide 6 and abutment 7 are held in their position by the ring 8 encircling both parts and being connected by the screw 9 to the breech casing.

In the cylindrical interior of the breech casing is placed the breech bolt of the non-rigidly locked type which supports the bottom of the cartridge shell mostly by its inertia and which in the usual way is allowed a rectilinear movement of suitable length relatively to the breech casing and is controlled by the main spring 5.

The breech bolt consists of three parts: the bolt proper 14 and striker 15 which are connected by the inertia lever 16 pivoted in the rear end of the bolt 14.

The principle of this main lever is known from other inventions (see British Specification No. 26783 A. D. 1912). The two armed inertia lever is pivoted in the rear part of the bolt 14. Its short arm *b* projects downward from the bolt whilst its long arm *a* is in loose connection with the striker. When the bolt 14 moves backward under the pressure of the powder gases, the lower, short arm of the inertia lever hits the abutment 7, whereupon its long arm pushes back with increased velocity the striker 15 relatively to the bolt 14.

Accordingly, the weight of the striker asserts itself more effectively than if the striker moved only with the speed of the breech bolt, in proportion to the existing leverage, or the proportion in which stand the lengths of both arms of the two armed inertia or locking lever.

In other inventions of this kind of breech bolt mechanism either the striker and the inertia lever are held in their unlocked or in their locked positions by some separate spring controlled sear, or, alternatively, the striker and the inertia lever are allowed to return into their unlocked positions relatively to the bolt proper and because then, in the last phase of their return movement the lower, short arm of the inertia lever would run up against the abutment in the breech casing, this abutment of the inertia lever is adapted for moving out of the way of the lower arm of the inertia lever during the return movement of the latter.

In our invention we avoid this complication by giving a third arm *c* to the inertia lever, which can be called an extension of the short arm *b*. This third arm *c* of the inertia lever is adapted for keeping the inertia lever 16 and with it the striker 15 during the repeating movement of the bolt, in their cocked position, by the end of this arm *c* sliding on the wall of the breech casing

and thus hindering any forward rotation of the inertia lever, until the arm c on its return way has passed the abutment **7**.

The longer is the extension c, the less is its pressure on the wall of the breech casing. A convenient length of the extension c is chosen (Figs. 1 and 2) at which this pressure remains within convenient limits.

Considering that the main spring **5** constantly strives during the recoiling and return movement of the bolt to cause forward rotation of the inertia lever **16** so that the extension c of its short arm b is constantly pressed against the wall of the breech casing, thus causing undesired friction, we arranged in the end of the extension c of the arm b of the inertia lever **16** a roller **17** in order to avoid the undesired friction.

Another source of undesired friction is the fact that the same force which presses against the wall of the breech casing the end of the extension c of the arm b of the inertia lever, strives to lift the pivot of the inertia lever, thus pressing the bolt and the striker against the upper wall of the breech casing **2**. Another undesired friction is thus caused which also must be eliminated as far as possible. We accomplish this by employing another roller **18**, sitting in the top of the striker, preferably near to its forward end and approximately above the roller **17** in the extension c of the arm b of the inertia lever **16**, when in its cocked position.

Thus, when the pressure of the powder gases forces the bolt backward, the main lever **16** pushes back the striker **15** into its cocked position and keeps it there, without the help of other parts, during the whole subsequent backward and forward movement of the bolt.

When, toward the end of its forward movement the extension c of the arm b of the inertia lever has passed the abutment **7**, the inertia lever **16** is allowed to rotate forward under the pressure of the main spring **5** the striker advances and fires the cartridge in the barrel.

A handle **19** is connected with the striker, being passed therethrough, and this handle is capable of being inserted or removed after removing the cap of the breech casing and subsequently retracting the bolt until the handle hits the rear end of the slot in the right wall of the breech casing. When the handle **19** has been removed the bolt can be freely withdrawn.

The trigger mechanism may be of the conventional design.

The firing pin **30** is inserted between bolt **14** and striker **15** and held in correct position by its wing **31**, fitting into the recess in which sits the roller **18** of the striker **15**. This disposition allows very easy change of the firing pin in case of damage.

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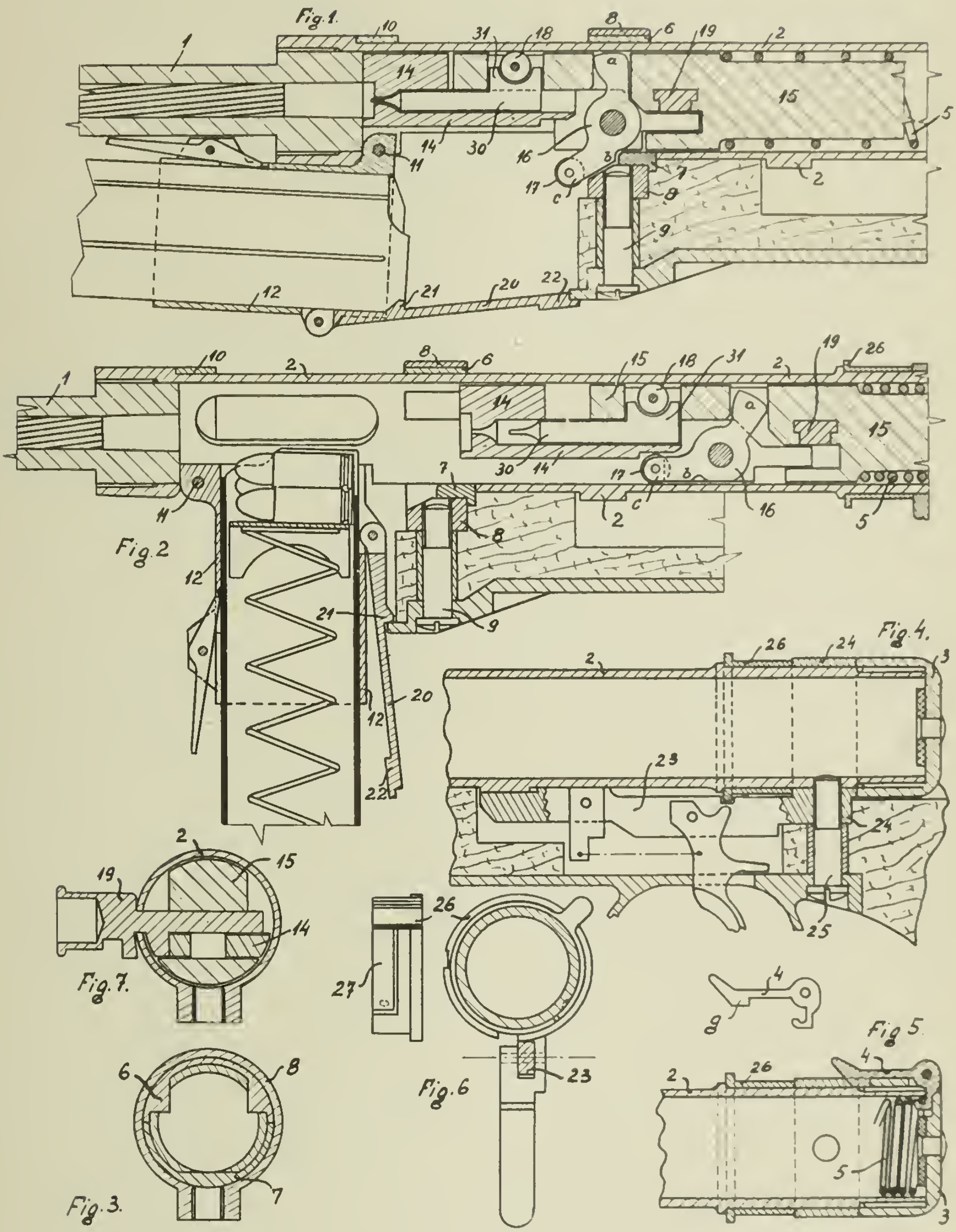
PUBLISHED
APRIL 27, 1943.
BY A. P. C.

P. DE KIRÁLY ET AL
BREECH MECHANISM FOR AUTOMATIC FIREARMS
Filed Nov. 13, 1939

Serial No.
304,226



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Published Apr. 27, 1943

Serial No. 304,632

ALIEN PROPERTY CUSTODIAN

MANUFACTURE OF FLEXIBLE SHEET METAL

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No Drawing. Application filed November 15, 1939

This invention relates to the manufacture of flexible sheet material and particularly material adapted or intended for use as film stock or otherwise as a support for photographic material.

It is known that films of cellulose esters are produced from solutions of these esters, in volatile organic solvents with or without softening agents.

The method of producing film stock involves the deposition on to an endless band or carrier of a layer of this solution of the ester and the evaporation of the solvent under the action of heated air.

In the known methods this heated air is conducted in such a way that it flows over the whole upper surface of the solution deposited on to the carrier. This heated air must be constantly kept at a temperature below the boiling point of the solvent otherwise bubbles will be produced during the evaporation of the solvent. This limitation of temperature has the result that the production cannot be carried out with the desired speed, which is an economic drawback.

It is further known that a film must have a certain degree of flexibility, otherwise it does not satisfy all the requirements of for instance a support for photographic material. For the purpose of obtaining this required flexibility, to the solution of cellulose-esters, bodies are added which may function as softening agents; however the addition of these bodies has the disadvantage of diminishing the tensile strength of the film.

The invention helps to diminish appreciably the mentioned disadvantages of the known methods of producing films.

We have found that in producing films from solutions of cellulose-esters in volatile organic solvents, with or without softening agents, unexpectedly favourable results are obtained, if in addition to the heating of the space above the solution layer, to a temperature lower than the boiling point of the solvent, the space immediately beneath the carrier is heated to a temperature appreciably higher than the boiling point.

It is surprising that, although the temperature beneath the carrier is higher than the boiling point, the evaporation of the solvents takes place without forming bubbles in the layer; due to this high temperature the evaporation of the solvents takes place at a quicker rate and it is possible to increase the speed of the production of the film.

It is also surprising that the film produced by the new method possesses a greater flexibility than by the known methods. It follows that the desired flexibility of the film can be obtained with less softening agents and that consequently the tensile strength can be augmented.

The invention therefore comprises the method of forming films from cellulose-ester compositions, which includes the deposition on to a flexible band, of a solution of such ester in volatile organic solvents, with or without softening agents, subjecting the deposited layer to heat, at the upper side at a temperature below the boiling point of the solvent and at the rear side at a temperature appreciably higher than the boiling point.

For supplying heat to the space above the carrier, a continuous stream of heated air can be applied. For supplying heat to the space at the rear side, several types of heating bodies can be used as for instance an arrangement of tubes through which steam or a heated fluid is passed, or rollers which are in contact with the carrier and are therefore kept in movement, or electric heating means.

The following particulars are given by way of example for the purpose of comparing the results obtained in treating particular solutions of cellulose esters by applying heat to the upper side of the film only, and by proceeding in accordance with the invention, that is to say by subjecting the deposited layer to heat at the upper side of the film at a temperature below the boiling point of the solvent and also at the rear side at a temperature appreciably higher than the boiling point of the solvent.

Example 1

Cellulose diacetate was dissolved in acetone (boiling point 56°) and deposited on an endless carrier. The air above the carrier was heated to a maximum temperature of 45° C. for the purpose of avoiding bubbles due to the solvent boiling. The film which was obtained in this manner had a tensile strength of 7.5 kg. per m^2 and an elongation of only 27.7%.

When, however, in accordance with the invention, the air above the carrier was heated to the temperature above indicated and the space beneath the carrier was heated to 80° C. the film obtained gave an elongation of 33.2%.

Example 2

Cellulose triacetate was dissolved in methylene chloride (boiling point 40°) and alcohol. During casting the air above was heated to a maximum temperature of 38° C. The film had a ten-

sile strength of 9.5 kg. and an elongation of 16.6%.

When, however, in accordance with the invention, the space beneath the carrier was in addition heated to 90° C. the film obtained gave an elongation of 25%.

Example 3

Cellulose aceto-butyrate was dissolved in methylene chloride and alcohol. The air above the carrier was heated to a maximum temperature of 38° C. To obtain the required dryness of the film when stripping it from the carrier, the speed of the carrier could not be increased above about 1 metre per minute.

When, in accordance with the invention, the space beneath the carrier is in addition heated to 85° C. the speed of the carrier could be raised to 1.5 metres per minute to secure the same dryness when removing or stripping the film from the carrier.

REMI GUSTAVE TRITSMANS.
SERGE HENDRICX.

Published Apr. 27, 1943

Serial No. 304,834

ALIEN PROPERTY CUSTODIAN

AIRCRAFT POWER PLANTS FOR HIGH ALTITUDE FLIGHT

Georges Boulet, Plessis-Robinson, France; vested in the Alien Property Custodian

Application filed November 16, 1939

My present invention has for its object to provide an aircraft engine for flight at high altitude, more especially in the stratosphere, which is more particularly intended for long distances and has a low specific consumption, which is ensured by its cycle of operation, independently of the other known means that may likewise act to decrease such consumption (adjustable richness carburettor, injection of gasoline into the pipes or into the cylinder, injection of additional liquid, special chamber, etc.), said low consumption existing at its normal altitude of operation and preferably also under all conditions of operation at any intermediate altitude.

As the flying ranges are inversely proportional to the specific consumption, any decrease of consumption increases either the flying range or the loading capacity, or the ceiling or combinations of these qualities.

The constant power at all altitudes increases the speed and the safety of the flights, and gives the pilots or passengers the ability to support high speeds owing to a relative decrease of vertical accelerations in rising gusts.

For very long flights, these two abilities are therefore those which form the basis for the design of aircraft as a propelling and lifting machine.

In order to combine these two qualities, recourse is had to the usual combination of an engine of an engine of the explosion type and a system of air compression which is capable of supplying the engine at high altitude with fuel at the requisite pressure, but, and this is a remarkable pecularity of the invention, the engine used is of the high volumetric ratio type (higher than 8) and undercharged, that is to say wherein the pressure p'_0 at the end of the intake stroke with the throttle wide open is lower than the atmospheric pressure on the ground. This pressure p'_0 is dependent on the octane index of the fuel that can be employed in normal operation at the altitudes in question.

Said engine may be of the explosion type, operating by means of a carburettor or of an injection of gasoline either into the inlet pipe, or directly into the combustion chamber. In any case a high volumetric expansion ratio is used.

The undercharging may be obtained either by means of a throttling of the intake, or preferably by means of a distribution which is adjustable in flight, or by means of unequal strokes of the piston, etc.

The adjustable distribution is more particularly advantageous since it enables the duration of intake on the ground to be limited and a normal setting and a normal duration of intake to be restored the altitude Z_1 at which the external pressure is equal to the pressure p'_0 at the end of the intake. Furthermore, it enables when on the ground a small overlap to be obtained of the periods of closing of the exhaust and of opening of the intake, and a substantially greater overlap to be obtained at the altitude Z_1, which permits of a very considerable scouring (in particular a scouring by pure air in the case of gasoline injection), which favours the cooling of the chamber and increases its ability to support a higher volumetric ratio.

In the case of injection of gasoline directly into the combustion chamber, the under-charging by means of adjustable distribution may be effected on the ground by means of a delay or storing, that is to say that the closing (of the intake valve or valves or of the intake distributor or distributors) will be late, thereby driving the air into one or other of the pipes, preferably the intake pipe, the adjustment becoming normal again at the altitude Z_1 called reference altitude.

Similarly, the delay might be considered in engines provided with carburettors with a buffer chamber between the cylinders and the members controlling the intake.

Similarly a system called after-charging might be considered, in which the intake at the pressure Z_1 takes place at that part of the end of the intake stroke during which the piston only undergoes small movements.

The variable adjustment can be obtained either by a lateral movement of variable contour camshafts, or by the relative angular movement of two camshafts, the action of which on the distribution is added or subtracted, one or both being movable during operation relatively to their actuating member, or by means of distributions with wandering sleeves or the like which permit of a variable or invariable adjustment of the distribution, or any combinations of sleeves, valves, rotating plugs or slide-valves, which are suitable for obtaining the same results.

In all the cases, the device for controlling the adjustable distribution is preferably provided with a manometric capsule which is influenced by the pressure in the intake pipe before the intake valve, so as gradually to vary the closing point of the intake.

Whatever be the manner in which the undercharging is obtained, the system of air compression is preferably controlled by a manometric de-

vice which renders it operative automatically under predetermined conditions.

It ensues from the foregoing that the intake pressure in the engine can be kept constant from the ground up to the altitude Z_1 where the atmospheric pressure becomes equal to this intake pressure. The power of the engine therefore remains substantially constant between the same limits of altitude (for example between 0 and 5,000 metres) without the intervention of the air compressing system. The starting of the latter, which is preferably effected automatically as soon as the altitude Z_1 is passed, enables said intake pressure to be kept constant up to the maximum altitude Z at which said system is capable of restoring the intake pressure. From O to Z the engine consequently operates under the most efficient conditions.

The cycle of operation of an under-charged engine has as its particular feature a lower exhaust gas temperature than that of normal engines, owing to the high expansion ratio.

An advantageous development of the basic arrangement of the present invention consequently consists in forming the driving part of the pressure restoring system completely or partly by one or a plurality of turbines actuated by the exhaust gases, since the resistance and the efficient operation of said turbines are proportional to the moderation of the temperature, the part of the restoring system which is not driven by turbines being in this case actuated by the engine through a mechanical transmission.

In a preferred embodiment of this development, the engine is provided with a distribution which is adjustable during operation and the pressure restoring system comprises a mechanically driven compressor which is capable of restoring the pressure p'_o up to the altitude Z_2. There exists on the exhaust a valve controlled by a manometric capsule, in such a manner that from a predetermined altitude, at least equal to Z_1 where there is a pressure equal to the constant intake pressure, said valve maintains in the exhaust pipe a constant pressure p_e which is intermediate between said consant intake pressure p'_o and the atmospheric pressure at the maximum altitude Z_2 at which the compressor can restore said constant intake pressure, and there exists at least one turbo-compressor actuated by the exhaust gases, the turbine of which is adapted to operate at a pressure drop equal to the difference between said constant exhaust pressure and the pressure corresponding to the maximum altitude Z_3 at which the pressure Z_2 can be restored by the compressor which is driven by said turbine and the discharge pipe of which is connected to the suction pipe of the mechanical compressor.

This arrangement enables an automatic scouring of the engine to be obtained at the end of the intake at a pressure $p'_o—p_e$.

In this latter arrangement, an air radiator is preferably interposed in the pipe connecting the turbine-driven compressor to the suction pipe of the mechanically driven compressor.

This embodiment may be provided with a second compressor which is likewise driven by the exhaust gases and is capable of restoring the pressure which prevails at altitude Z_3 up to an altitude Z_4. In this case, the driving part of the restoring system may comprise a single turbine with convergent-divergent nozzles to absorb the total pressure drop from Z_e to Z_4, said turbine actuating the two compressors which restore the pressures Z_2 and Z_3; said driving part may also comprise two turbines in parallel which actuate separately each of said compressors and are each adapted to operate at the pressure drop from Z_e to Z_4, or again two separate turbines which are adapted to operate in series, one at the pressure drop from Z_e to Z_3 and the other from Z_3 to Z_4.

These pressure drops may be those which correspond to the critical pressure drop equal to 0.52 at which maximum efficiency is obtained.

Furthermore, these turbines which operate at a constant inlet pressure Z_e may be of the staged type or of any known type.

Similarly turbines might be considered which operate on the exhaust "puff"; they would be called variable pressure turbines. In this case several arrangements could be considered inter alia:

(*a*) The turbines would be connected to the exhaust outlets so that there would be no interference with the exhaust periods, each group formed being adapted to act on a turbine or a part of a turbine.

(*b*) A special exhaust valve or a device which only acts during the puff period, that is to say from the opening astride on the extreme low position, at which instant the piston is nearly stationary, the other valve or device being provided either with a normal control in the case of the pure under-charged engine, or a control for varying the adjustment.

In this case, the scouring pressure would constantly increase while climbing.

From the altitude Z_e, the cycle of the engine remains constant and its sole difference with the cycle up to the altitude Z_1 consists in the pressure drop at the exhaust between Z_1 and Z_e, thereby producing an increase of power which partly compensates for the power absorbed by the mechanical compressor.

The foregoing arrangement may be further improved by forming the air intake for the compressor which restores the pressure at the altitude Z_3 or Z_4, by a divergent nozzle which converts the velocity of the air into pressure and is preferably arranged in the zone located behind the propellers where the air is accelerated relatively to the actual speed of the aircraft. This improvement enables the pressure p'_o to be restored up to an altitude Z_m greater than Z_4 and called end of constant pressure altitude and which is consequently the end of constant power altitude.

Said air intake could also, for flying on a level from Z_1 to Z_2, eliminate the necessity of providing a mechanical compressor. However, the arrangement with an intermediate mechanical compressor is preferable, since when climbing the compression effect of the air intake is substantially decreased owing to the decrease of speed on the course.

The energy which is still available in the gases at the outlet of the turbines may again be recuperated by connecting an outlet shaft for said gases to a recuperating system of the known type.

The recuperable energy in the cooling liquid may also be recuperated by means of suitably designed radiators, as is known.

The chief advantage of the above defined arrangement is that the power to be supplied to the pressure restoring system relatively to the constant mass introduced and to the altitude Z_4 in question, is very much lower than that which would be required for normal engines, the thermic efficiency of which is lower. In fact, since the power produced per kilogramme introduced is in a

ratio of 1 to 1.4 in favour of the high thermic efficiency engine, a greater intake mass is required to obtain the same power with a normal engine and consequently larger compressors which absorb more power, thereby reducing the final power output.

Furthermore, since the pressure to be restored is much lower, the temperatures at the end of the compression are lower and the air radiators smaller.

On the other hand, at the instant when the quick climb stops and when the flight continues with a very gentle climb, as the aeroplane becomes lighter, the mechanical compressor can be stopped and will then only act as a conveyor, or it can be cut out of the system and its action replaced by that of the dynamic pressure in the shaft. It will be reintroduced into the system when its action becomes necessary again, that is to say on the level located below the end of constant intake pressure altitude, by an amount corresponding to its compression ratio.

On the other hand, the engine itself offers relatively to normal engines the advantage of having a compression ratio which is adapted to the degree of use provided for a long operation, whereas a normal engine, which is used for example at $^{65}/_{100}$ of its power, is thermically inefficiently utilized.

In order to enable the invention to be better understood, four diagrams of the power cycle which serves as a basis for the present invention have been shown in Figs. 1 to 4 of the accompanying drawing.

Fig. 5 is an indicator diagram of said cycle.

Figs. 6 to 9 show partial diagrams at different altitudes of under-charged engines.

Fig. 10 shows diagrammatically, by way of a nonlimitative example, an embodiment provided with the various peculiarities mentioned above,

and Figs. 11 and 12 show diagrammatically a modified embodiment.

In the complex embodiment shown in Fig. 10, the basic combination of the whole arrangement is formed by that of an under-charged engine shown diagrammatically at 1 and by a compressor 11. The general cycle of the type of engine 1 is shown in Figs. 1 to 5.

Each of Figs. 1 to 4 shows one of the strokes the four-stroke cycle of this under-charged engine, Fig. 1 corresponding to the end of the compression, Fig. 2 to the end of the expansion, Fig. 3 to the end of the exhaust and Fig. 4 to the end of the intake. In these figures, e designates the height of the combustion chamber and r' the volumetric expansion ratio. The pressure of the temperature is designated by p_1T_1, at the end of the compression stroke, p_2T_2 at the end of the explosion stroke, p_3T_3 at the end of the expansion stroke, $p'_0T'_0$ at the end of the intake stroke.

Fig. 5 shows the theoretical diagram corresponding to the (adiabatic) compression stroke (AB) and the (adiabatic) expansion stroke (CD). This diagram remains the same whatever be the manner in which the under-charging is effected.

The consequences of two different manners of effecting the under-charging are shown in Figs. 6 to 9 which are figurative diagrams of the intake and exhaust strokes. Figs. 6 and 7 relate to an engine which is under-charged by throttling the intake, Figs. 8 and 9 an engine which is under-charged by closing the intake valve long before the end of the stroke of the piston. In these diagrams, P_0T_0 respectively designate the pressure and the temperature at altitude o.

Fig. 6 shows the operating diagram at the altitude at which the end of intake pressure p'_0 prevails, whereas the diagram of Fig. 7 is that of the operation at the altitude o. It will be seen that in this latter case there exists a work of suction represented by the area AELI which is far from being negligible. This loss has almost entirely disappeared in the diagram of Fig. 9 in which the undercharging is obtained by closing the intake valve at a point E_1 corresponding to an intermediate position II of the piston in its intake stroke (Fig. 4) which is chosen in such a manner that the mass introduced expands during the remainder of the intake stroke according to the adiabatic curve E_2A which is as close as possible to the adiabatic curve AE of the compression stroke of the general cycle (Fig. 5). The diagram of Fig. 8 is equivalent to that of Fig. 6, save that this particular manner of undercharging the engine by varying the instant of closing the intake valve enables the intake valve to be closed at the altitude p'_0 only after the closing of the exhaust valve and thereby enables a scouring to be obtained which has the effect of increasing the power owing to the fact that the cylinder is entirely cleansed of burnt gases and is consequently filled with a more considerable mass of fresh gas than when burnt gases remain; furthermore, the volumetric ratio of the combustion chamber can be made higher owing to the cooling of the combustion chamber by the fresh gases and to the lower temperature of the mass at the end of the intake.

In this embodiment of Fig. 10, the engine 1 is of the high volumetric compression type, for example higher than 9, and has two camshafts 2 and 3, the camshaft 3 being angularly displaceable during the operation of the engine, for example by means of a device of the type described in French Patent No. 672.335, in the name of the same applicant. 4 designates the intake pipe, 5 the intake valve, 6 the exhaust valve, 7 the exhaust pipe, 8 a usual supply carburetter and 9 the usual butterfly valve for controlling the power of the engine; 10 is an air intake located on the intake pipe after a compressor 11 which is mechanically driven by the motor 1; 12 is a throttle valve for the air intake 10 and is controlled by a manometric capsule not shown and subjected to the influence of the pressure prevailing in the intake pipe 4. On the intake pipe of the compressor 11 which is connected through a pipe 15 and an air radiator 16 to the delivery pipe of another compressor 17, is arranged at 18 an air intake direct from the atmosphere, which air intake is controlled by a valve 19 controlled by a manometric capsule not shown and subjected to the pressure that prevails in the intake pipe 4 or in the pipe 15. Said compressor 17 has its intake pipe connected through a pipe 20 and an air radiator 21 to the delivery pipe of another compressor 22, and 23 designates a direct air intake arranged on the intake pipe of the compressor 17; a valve 24 controls said air intake 23 and is actuated by a manometric capsule not shown and subjected to the pressure in the intake pipe 4 or in one of the pipes 15, 20. The air intake of the compressor 22 is shown at 25.

The compressors 17, 22 are each respectively mounted on the shaft of a turbine 27, 28. Said turbines are coaxial and their outer case is common but divided into two compartments each containing one of the wheels 27, 28. It is into the compartment of the wheel 27 which drives

the compressor 17 that the exhaust pipe 7 leads and said compartment is provided with a direct exhaust pipe 30 controlled by a valve 31. The compartment of the wheel 28 is likewise provided with an exhaust pipe 32 opening directly into the atmosphere, without a valve, and it communicates with the other compartment. Finally, on the exhaust pipe 7 is arranged between the engine and the turbines an exhaust pipe 36 controlled by a valve 37 which is actuated by a manometric capsule subjected to the pressure prevailing in the exhaust pipe 7.

The operation of this arrangement is as follows:

On the ground, all the valves 12, 19, 24, 30 and 37 are open. The engine is designed to operate at an inlet pressure of 405 mm. which pressure is that prevailing at an altitude of 5.000 metres, and this is obtained by appropriately covering up the opening periods of the intake valves 5 and of the exhaust valves, by means of the movable camshaft 3; the settings from the upper dead centre are for example +0 and +130 for the opening and the closing of the intake valve 5 and +135 and +10 for the opening and the closing of the exhaust valve. The exhaust takes place through the pipe 36, the valve 37 being wide open. Up to the altitude of 5.000 metres, the intake pressure remains the same by an appropriate adjustment of the camshaft 3, either by hand, or automatically by means of a manometric capsule subjected to the intake pressure. The setting at 5.000 metres is for example —10 and +225 for the intake valve 5 and +135 and +30 for the exhaust valve 6. At 5.000 metres the valve 12 is closed, either automatically by a manometric capsule influenced by atmospheric pressure, or the pressure in the intake pipe, or by hand. At the same time, the mechanical compressor is started if same is not constantly driven by the engine. The suction then takes place through the air intake 18 and the valve 19 more or less throttles said air intake so that the intake pressure always remains equal to 405 mm. From 6,500 metres, the closing of the valve 37 starts and a portion of the exhaust gases passes through the turbine 27, thereby actuating the compressor 17 which drives air through the pipe 15 but at a pressure which is that determined by the valve 19. At 8,000 metres, the maximum altitude at which the compressor 11 can restore the pressure of 405 mm., the valve 19 closes completely and the valve 37 is completely closed; the exhaust is then effected completely through the turbine 27 and the pipe 30, while the air intake takes place through the pipe 23 which is suitably throttled by the valve 24 so that the intake pressure is constant. The turbine 27 operates at that instant at a pressure drop equal to the difference of the pressures at 6,500 and 8,000 metres and the compressors 17 and 11 act in series and restore the pressure of 405 mm. up to 11,500 metres. Towards this altitude or slightly before, towards 10,700 metres for example, the closing of the valve 31 is effected so that the exhaust then takes place through the two wheels in cascade 27 and 28 and the pipe 32; then at 11,500 metres the valve 24 closes, so that the supply of air to the engine is effected through the pipe 25 and the passage of the air successively through the three compressors 22, 17 and 11, which restore the pressure of 405 mm. up to 15,000 metres.

The power of the engine 1 therefore remains substantially constant between 0 and 15,000 metres. Above 15,000 metres there is a decrease of power of the engine. However, it can still be kept constant for some time by giving the air intake the shape of a divergent nozzle which converts the kinetic energy of the relative wind into pressure energy. Calculation in the example would show that the power could be kept constant up to 17,500 metres

In the modified embodiment of Fig. 11, the engine is provided, in addition to its normal exhaust valve 40, with a special exhaust valve 41, or with a similar device called "puff" device, that is to say which opens astride on the lower dead centre, at which instant the piston is nearly stationary and opens into a pipe leading to a variable pressure turbine 42.

The valve 40 is provided with a normal control or with a control that can be adjusted in flight.

Fig. 12 gives an example of such a control; in this example, the puff valve 41 remains constantly open from A to B, whereas the normal valve 40 is open from A to C on the ground and from A to D at 5,000 metres.

Of course, the invention is in no way limited to the details of construction illustrated or described, which have only been given by way of example. Thus, the numerical data given above are in no way absolute and the plant described could be designed to operate between other limits of altitude without thereby exceeding the scope of the invention. The same applies to the location and to the number of the members such as carburettors, radiators, etc.

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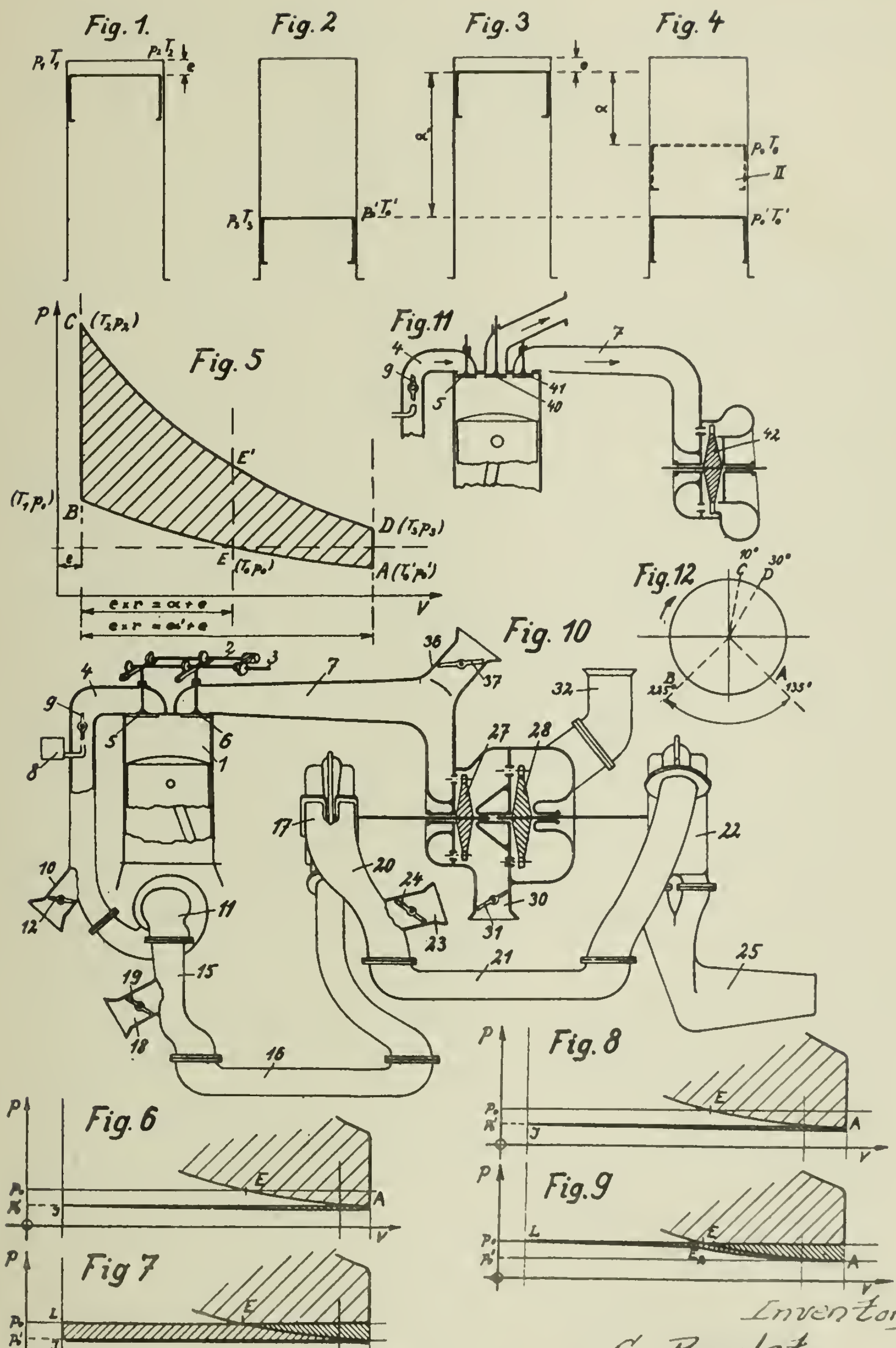
PUBLISHED

APRIL 27, 1943.

BY A. P. C.

G. BOULET
AIRCRAFT POWER PLANTS FOR
HIGH ALTITUDE FLIGHT
Filed Nov. 16, 1939

Serial No.
304,834



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Published Apr. 27, 1943

Serial No. 304,843

ALIEN PROPERTY CUSTODIAN

PROCESS FOR DEHYDRATING VEGETABLE PRODUCE

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No Drawing. Application filed November 16, 1939

The invention relates to a method for the dehydration of vegetable produce, whereby the dehydrating gas, preferably air, is blown through the substance to be preserved in one direction of flow.

The hitherto known methods for the dehydrating of vegetable produce by blowing a current of air through it, have the disadvantage that important differences are found in the quality of produce being dehydrated at various times. This applies in particular to the case of vegetable produce consisting chiefly of parenchyma.

This is due to the fact that the circumstances attending dehydration always vary. The only factors, which can easily be kept constant during the process of dehydration with atmospheric air, are the temperature, and the rate of flow of the dehydrating gas. This is, however, insufficient for always obtaining a satisfactory dehydrated product. Indeed, one factor which varies continually is the moisture content of the air. Tests made by the inventor prove that it is on account of this varying moisture content that the quality of dehydrated products varies. It is true that the relative humidity of the air used for drying could always be given a predetermined value by selecting the temperature for the drying air in relation to the moisture content of the atmospheric air; but then, on damp days, for many products this temperature would be too high for the obtaining of a satisfactory final product. Moreover, by this means one would only be shifting the difficulty, because now, instead of working with a variable moisture content in the drying air, one would have to deal with variations in its temperature.

The moisture content of the air applied could, of course, be kept constant by drying it previously in a drying installation, but this involves expensive apparatus, and is too costly for use on a large scale.

Another factor, which always varies and which can never be kept constant, is the state the produce is found in, as well as its own peculiar properties. So, vegetables or greens for cattle, picked in the autumn, contain a greater proportion of solid substances, than those picked in the spring. Differences are also found in produce gathered from two separate allotments, whilst there are also variations in produce when it is picked in the morning, and the same produce when picked in the evening. Furthermore, every produce does not give off its moisture to the drying gas passing along it with the same degree of facility. There is no method for keeping or making these factors constant. The invention, therefore, is based on the view that, in order to be always able to obtain a dehydrated product with the required properties, one must not attempt to standardize the various factors in the process of dehydration, but, on the contrary, such measures should be taken as enable one to adapt the drying process to meet these differences.

This the invention attains, by regulating the flow of the current of the dehydrating gas in relation to its temperature, the moisture content in the produce to be dehydrated, and the degree of moisture in the dehydrating gas, in such a way that in no event shall condensation take place in the drying-chamber.

This method enables one to dehydrate any given produce in the most favourable manner in one single drying apparatus, since it is now always possible to regulate the flow of current of the drying gas to suit given conditions. By preference, this is done by means of one or more exhausters, which can be driven with any required number of revolutions. The permissible temperature for the dehydrating gas depends especially on the kind of produce one wishes to dehydrate. It is known that it is undesirable to apply too high a temperature. According to the invention, however, it is not preferable to apply always the same temperature to the same kind of produce, but the temperature of the dehydrating gas may be regulated to meet the conditions of each different produce to be dehydrated. So, for instance, a higher temperature can be used to dehydrate summer and autumn produce, than to dehydrate spring produce or produce raised under glass. As a general rule, it may be laid down that the temperature of the dehydrating gas must be lowered in proportion as the tissues of the produce to be dried are tender, and the facility with which these give their moisture.

The method of adaptation described above can be still improved by applying the already known counter-current principle, that is to say, by conveying the produce in the dehydrating-chamber against the current of the dehydrating gas. This is most easily done by installing dumpgrates in the dehydrating-chamber.

In further explanation of the process used in the invention, the dehydration of spinach is given hereunder as an example.

The temperature permissible for the dehydrating gas in drying spinach is 50° C. First of all, in accordance with the nature of the leaf tissue, the temperature for the dehydrating air is decided upon. It is inadvisable to choose too high

a temperature, in order that as far as possible, the chlorophyl, vitamins, aromatic elements, imbibition capacity, etc., may be preserved. In the case of spring spinach having a tender leaf tissue, a temperature of 40° C would, for instance, be chosen for the dehydrating gas. After this, the relative humidity of the air is measured, and thereafter the moisture content of the spinach is estimated or determined.

Whenever the relative humidity of the dehydrating gas is low, a slower current may be used in order to obtain that with the low temperature of the gas, the discharged air is as saturated as possible with vapour.

In proportion as the moisture content of the spinach increases is the rate of the current raised. In this connection, the total number of revolutions made by the ventilator is, for instance, fixed at 400 per minute, (approximately 425 m^3 of air per minute). Thereafter the spinach may be introduced into the dehydrating apparatus and the drying begins.

To make sure that the right speed has been chosen for the current of air, the moisture content of the discharged air may be measured. Should this appear to be too low, then the speed of the dehydrating gas may be lowered, or vice versa. In this connection, directly after determining the temperature suitable for the dehydrating air, the ventilator may be brought into action, fixing its speed in accordance with the indications on a hygrometer placed in the pipe for the discharged air.

A chamber containing several rotating grates is preferably selected for the dehydrating apparatus. Through the under wall of this chamber a supply pipe extends into the latter, by means of which the air is supplied to the dehydrating apparatus at the required temperature by one or more ventilators, which can be adjusted to make any required number of revolutions. The upper wall of this chamber is provided with one or more discharge openings for the discharged air extending through said upper wall into the chamber and with one or more openings through which the produce to be dehydrated may be introduced. In consequence of the rotation of the grates, this produce falls gradually on to a lower grate, until after leaving the lowest grate, it falls into the lower part of dehydrating-chamber so that it can be removed from there. So, in this way, the produce to be dehydrated is moved against the current of air. Experiments have proved that this, in conjunction with the process according to the invention, exercises a most favorable influence on the quality of the dehydrated produce. In order not to make the chamber unnecessarily high, some of the grates can be made as a crossdumpgrate. Moreover, by this means, through the rotation of these crossdumpgrates, the produce is turned over on the same level, which affects its quality favourably, because, in this way during the process, every particle of the produce is brought into contact with drying air having the same characteristics. Preferably, at least for the middle grates crossdumpgrates are used. It may be observed, however, that also the other grates contribute in bringing every particle of the produce into contact with the dehydrating air.

It makes no difference how the atmospheric air is heated, so long as care is taken to see that, before it is driven or sucked into the dehydrating-chamber it has been heated uniformly. In connection with the speed of the currents used with the process described above, it is absolutely necessary to pay particular attention to this, as these high currents may easily bring about changes in the composition of the heated air. The air can be heated equally well by electricity, as by a system of pipes heated by one or more stoves.

In order to make the invention quite clear, two examples of its method will now be described.

Example I

On the topmost grates with a surface of 8 m^2 100 kg. of spinach was placed, as and when required. The thickness of the layer of spinach on these grates amounted approximately to 8 or 10 cms. The moisture content of the atmosphere was 64%. Air at a temperature of 45° C, and with a moisture content of 35%, was introduced into the apparatus. The temperature of the air in the exhaust-pipe was 30° C, and its humidity 95%. The exhauster emitted 425 m^3 of air per minute, whilst the grates were dumped every 15 minutes. The apparatus in question possessed two ordinary grates and three crossdumpgrates, so that the total drying time for each quantity of spinach was two hours.

Example II

On the topmost grates of the same apparatus, 100 kg. of grass was placed, as and when required. The moisture content of the atmosphere was 64%, and that of the grass 80%. The temperature of the drying air at the beginning was 85° C, and its moisture content 22%. The temperature of the discharged air was 35° C, and its moisture content 95%. The exhaustor emitted 550 m^3 of air per minute, whilst the grates were dumped every 5 minutes, so that the whole process occupied 40 minutes.

It should be noticed that in the above, particularly the influence of the various factors connected with the dehydration of produce containing parenchyma has been dealt with. The process according to the invention is, however, not limited to the dehydration of such produce alone, but can be applied with equal success to the dehydration of amylaceous and other vegetable produce.

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Published Apr. 27, 1943

Serial No. 304,867

ALIEN PROPERTY CUSTODIAN

PROCESS AND DEVICE FOR THE MANUFACTURE OF GAS MASKS

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Application filed November 16, 1939

Among the various processes used for the manufacture of gas masks through a moulding operation there is one which is a process by direct moulding of the mask in a mould and which consists in compressing a rubber sheet in the hot between, on the one hand, a core having approximately in relief the form of the inner part of the mask and, on the other hand, an outer mould formed of two—or more than two—parts which are themselves subdivided into segments which surround the core, these members of the mould (the inner and the outer one) being separated at the end of the compression operation owing to suitable stops, by a distance which corresponds to the thickness to be given to the mask, the different pieces of the mould being generally united by successive clamping operations and every one of the pieces acting on the adjacent one by compression. With such moulds it is intended to give, through the moulding operation itself, the desired shape to those parts of the mask which are designed for receiving the eye-pieces as well as the different soles or stands and eventually the anti-vapor conduits and also for securing the buckles designed for receiving the fastenings of the mask onto the head. But the moulds which have been suggested or made for this purpose show the disadvantage that their construction is very intricated and that they are formed of a very large number of pieces owing to the necessities of the extraction of the mask and of the adhering pieces out of the mould, so that these moulds are expensive and delicate. They are difficult to assemble and to handle with precision owing to their weight and to their intricateness and also owing to their bulk. The buckles for the fastenings of the mask and the forks for manufacture of the anti-vapor conduits are badly secured therein with the further result that an important waste arises during the manufacture. The cost of the masks made according to these previous processes is thus very high, not only because of the above mentioned disadvantages, more particularly as regards the duration of the loading operation, but also owing to the long period of time which is necessary for bringing the whole of the mould to the vulcanization temperature. This long period of time for bringing the masks to the desired temperature can lead for certain parts of the mask to troublesome vulcanization irregularities.

The present invention has for its object a process for the manufacture of gas masks by a forming process through a direct moulding operation, which permits of making the moulding of the mask with a great rapidity, with a great reliability in the manufacture and at a substantially reduced cost. Another object of the invention is a moulding device which is simple in its constitution and which is formed of a reduced number of pieces being themselves simple in form and sturdy as well as able to be brought rapidly and with regularity to the desired temperature and which are further able to be readily disassembled for the extraction out of the mask of the mould. Its application, according to the invention offers the possibility of simple moulding operations leading to rapid and reliable operations without an irregular displacement of the pieces which form the mould, being likely to be feared. On the other hand, the said device permits of maintaining fast in a very accurate manner the buckles of the fastenings of the mask as well as the fork for the formation of the anti-vapor conduits.

An embodiment of the invention is shown by way of example in the accompanying drawings, in which:

Figure 1 shows an assembly of chills or shells and jaws according to the invention, adapted for the making of a mask, this unit being seen in a half sectional view through A—A of Figure 2 and in a half sectional view through a vertical plane leading through a diameter of an eye-piece.

Figure 2 shows a front sectional view through B—B of Figure 1.

Figure 3 is a plan view in which the chills or shells are partially broken out.

Figure 4 is a longitudinal sectional view of the whole unit of moulding elements showing the head or core in position in the chills or shells and an arrangement for supporting the fork designed for forming the vents or conduits for the eye-pieces.

Figure 5 is a sectional view through C—C of figure 4 showing the arrangement of the heating elements of the mould.

Figure 6 is an elevational view on a smaller scale of a complete machine for making masks.

Figure 7 is an end view of the same.

Figure 8 is an elevational view with a partial sectional view of a fork carrier.

Figure 9 is an end view of the same.

Figure 9 is a horizontal sectional view through D—D of Figure 8.

Figure 11 is a sectional view of a particular arrangement permitting of insuring a ready extraction of the eye-pieces out of the mould.

Figure 12 is a sectional view through F—F of figure 13 of a moulding device for moulding pro-

jections for securing the fastenings or buckles of the mask body.

Figure 13 is a sectional view through G—G of figure 12.

Figure 14 is a sectional view through H—H of figure 12.

Figure 15 is a sectional view of a moulding device for moulding the hooks of the neck-band.

Figure 16 is a plan view of the same.

The mould shown in Figure 1 is formed of two jaws **1**—**2** in which chills or shells *3a*—*4a*—which, in the following, will be called chills—are inserted in fixed positions, the said chills being each made here of a single piece but it would also be possible to make them of a plurality of pieces. The inner surface of the same corresponds to the outer form of the mask. Instead of being made in the form of thick pieces which are, for instance, made by a casting operation, which would entail serious difficulties owing to unequal shrinkage, the said chills are formed of an inner thin part such as **5**, Figure 3, and of ribs **6** integral with the said inner part. Such a unit can be cast in metallic moulds and made, for instance, of light metal such as aluminum or aluminum alloys or any other known metals which are sufficiently resistent and able to be moulded by processes giving castings of a great accurateness, regular thickness and homogeneous structure. The castings obtained by such processes with metals of the kind as above referred to can thus be used in the raw state as they come out of the foundry or after having been subjected to a reduced machining operation limited to the plane surfaces which require a very great accurateness. The inner parts of the jaws may receive an exceedingly simple form, as for instance the form of a right-angled parallelopipedon which can be readily machined, as shown in chain dotted lines in the drawing, or of frusta of pyramids as shown in full lines and which can be obtained by moulding with subsequent lathing or mortising or even by means of plates having been prealably brought to the desired dimension by suitable known machining means and which are then welded together. Thus these jaws can receive chills the outer forms of which are rigorously similar but the inner forms of which are different and correspond, for instance, to masks of different forms or sizes.

The ribs **6** of the chills can be either arranged according to planes which are parallel one to another, as shown in the left part of figure 3, or be in the form of blades which are perpendicular one to another and form a kind of network or honey-comb, as shown in the right part of figure 3. Generally, it will be sufficient to make them in the form of parallel blades, since the unitary pressures in the moulding proper are comparatively low with respect to the resistance of the metal, even of soft metals such as aluminum. Besides their mechanical function as supporting and adjusting members for the chills in the jaws, the said ribs insure the transmission of the heat between the heating devices which will be described later on and the chills. It is to be noted that the chills showing the above mentioned characteristic features could be used in combination with moulding devices which are even different from the devices which will be described in the following.

A head or core which outwardly represents the inner form of the mask **11** is located between the chills **3***a*, **4***a* during the moulding operation. This head is formed in the same manner as the chills, that is to say it comprises a thin part of a substantially constant thickness forming through its outer surface the counter-moulding element with respect to the chills and eventually inner ribs which are similar to the ribs of the chills. In the moulding position, which is the position shown in Figure 5 the chills *3a* and **4***a* come to rest against the parts **11***a* and **11***b* of the head and, on the other hand, they rest one against the other at **10**. They are maintained in this position by the jaws **1**—**2** in which they are adjusted as above mentioned, a play **1***a* being provided between both jaws. It results from that arrangement that when the jaws **1** and **2** have been moved against each other as far as possible, a gap **11***c* is provided between the head **11** and the chills **3***a*—**4***a*. This gap **11***c* corresponds to the thickness which the mask must have after cooking. The head **11** is maintained in its upper part by a steel plate **11***d* forming a strut able to prevent the head being crushed down and which comprises a rod **12** capable of being adjustably secured on a movable support (which will be described later on) in order to permit an adjustment which will be as accurate as possible of the head **11** with respect to the chills **3***a*—**4***a*.

The heating elements are preferably formed of flat elements as shown in Figure 5. These flat elements such as **8**, **9**, **8***a*, **9***a* are located in receses provided in the jaws **1** and **2**. Another heating element such as **10***a* also secured in the head or core **11** by means of a shoe **10***b* of heat conducting material. Through pins **10***c* integral with the plate **11***d* the element **10***a* and the shoe **10***b* are maintain in their correct position. The said heating elements will be formed, for instance, of electric resistances which are arranged flat according to a well known method. It will be advantageous to select, for making the chills and the head or core, a metal having a high heat conductivity. In this respect aluminum, magnesium and their respect alloys possess properties which are particularly well suitable.

As shown in Figure 4, a support **12***a* is provided both for receiving a moulding element **13** serving for the formation of the base **14** of the mask and also for maintaining in position in the mould the fork designed for forming the anti-vapor conduits or vents of the eye-pieces. This support is formed of a rod **12***a* clamped between both chills **3***a* and **4***a*, Figure 5. The correct direction of this rod is ensured by a ring **13***a* which is located in two recesses provided in the chills **3***a* and **4***a*. The rearward end **15** of the fork extends through an opening **16** provided in the jaws **1** and **2** and is carried and guided by a fork-carrier which will be described later on.

The machine shown in Figures 6, 7, 8 and 9 is formed of a frame **17** carrying both jaws **1** and **2** of the mould which are united by two bars **20**—**21**. The jaw **2** is fast (as well as the corresponding chill **4***a*), while the jaw **1** slides on the bars **20** and **21** and carries with it the chill **3***a*. Its longitudinal movement is ensured by the rod **23** of a hydraulic press **24** the actuating lever of the pump **25** of which is shown at **26**. The half mould **1** is guided during its movement by means of ears **27**—**28** on the bars **20** and **21**. The hydraulic press **24** comprises a double-acting cylinder with a rapid approaching movement which permits of rapidly setting the half mould **1** either in order to move it away from the half mould **2** or for approaching it towards the same, and of finally effecting the pressure between the

said both half moulds for the moulding operation and the vulcanization.

Slidably mounted on the rod **21**, simultaneously with the half mould **1**, are an arm **32** pivotally secured for swivelling about the said rod **21**, and a bail **33** (Figures 8 and 9) the legs of which are mounted on both sides of the pivoting arm **32** and guided in their lower part by a guide-way **34** fast with the frame **17**. The pivoting arm **32** receives the vertical rod **12** which carries the head or core **11** by means of the plate **11***d* (Figure 4). The whole unit formed of the pivoting arm **32**, the rod **12** and the core or head **11** is balanced by means of a counter-weight **35** secured on a rod **36** (Figure 7) or on a rearward extension of the arm **32**.

The pivoting arm **32** is united by a hook **37** pivotally secured at **38** on the half mould **1** with the ear **27**. This hook has a lateral extension **40** which—when the half mould **1** has moved towards the left side of the drawing by a quantity which is sufficient that the head **11** has cleared off the half mould **2**—abuts against a stop **42** having a sloping surface and which is secured to the frame of the machine. This sloping surface raises the hook **37** by means of the extension **40** and discharges the arm **32** from the ear **27** and, accordingly, from the half mould **1**. Thus the latter can continue its movement towards the left side until it also clears off the head **11**. It is then sufficient to raise the pivoting arm **32** by causing it to rock about the rod **21** for completely disengaging the head **11** and raising it over both half moulds. On the hub **32***a* of the arm **32** is provided a projection **32***b* to which corresponds a stop **33***a* on a cross-rod **33***b* of the bail or strap **33**, in order to limit the angular displacement of the arm **32** during this disengaging movement.

In its lower part the bail or strap **33** carries the fork-carrier **12***a* by means of a stud **45**. A finger **46** fast with the stud **45** comes to rest against an adjustable stop **47** formed, for instance, of a screw carried by a strut **33***c* of the strap **33**. This stop permits of correctly giving the desired direction to the fork-carrier **12***a* with respect to the strap **33**. The support **12***a* carries a bi-conical ring **13***a* which can be clamped between two corresponding grooves of the half moulds **3***a* and **4***a* (Figure 4), while the whole is balanced by a counter-weight **49**. The arm **12***a* is mounted in the stud **45** by a square part **12***b*. The bearing surfaces **33***d* of the stud **45** in the arms of the strap **33** are ovalized and setting screws **50** permit of giving the stud **45** in the said bearing surfaces and accordingly to the support **12***a* positions which are more or less high corresponding to different dimensions of the mask and to different mould sizes.

The operation of the machine is as follows: The half mould **1** is brought to the left side of the machine by means of the jack **24** while simultaneously carrying with it the arm **32** and accordingly the head **11** as well as the strap **33** by means of the hook **37**. When the head is brought to such a position that it should be disengaged from the half mould **2**, the hook **37** is raised by the stop **42**, Figure 6, and the half mound **1** clears the head **11**. The operator raises the head by causing the arm **32** to upwardly rock about the rod **21** and he loosens from the head **11** the mask which has been thus formed. Fresh rubber sheets are put into the chills or they are put onto the head, after the accompanying dismountable pieces provided on both parts of the mould have been brought to their position, for moulding the eye-pieces and the fastenings of the buckle parts of the mask as will be described later on. Then the head is brought again to its lower position and the jack **24** is acted upon so as to push the jaw **1** towards the jaw **2**. During this movement the hook **37** moves away from its stop **42** and falls again onto the ear **27**. The hook **37** will finally occupy its clamping position when the jack **24** will have compressed the rubber and when the chills **3***a* and **4***a* will be perfectly united by their bearing portions. The mould being then heated the vulcanization operation will take place. Once the heating is achieved the head is raised in the above described manner. It it to be noted that it is possible, owing to the great facility of handling of the machine constructed according to the invention, to let this handling be effected by a female worker.

Instead of a single head **11** a plurality of heads can be advantageously arranged on the arm **32**. Figures 8 and 9 show the case of two symmetrically arranged heads. In this case the boss **51** which carries the rod **12** is pivotally mounted on the end **52** of the arm **32** and a rod **12′** opposed to the rod **12** and mounted on the support **51**, carries the second head. A latch **53** of known type (Figure 10) to which correspond two diametrally opposed holes **54***a*, **54***b* in the arm **32** permits of interlocking the rotating support **51** with the arm **32** so that it may be possible to bring at will either the arm **12** or the arm **12′** downwardly. Such a device with a plurality of heads offers great advantages. It permits especially of effecting the furnishing of the moulds in advance for securing the buckle-parts and of reducing the time which is necessary for loading the apparatus. On the other hand, it permits of stripping from the head the mask which has just been vulcanized only when another head has been brought to its position and when the machine has been started again, which also represents an important gain of time and offers the possibility of having the work of a plurality of machines surveyed by only a female worker in spite of the very short time which is necessary for the vulcanization.

The device for the formation of the eye-pieces as shown in Figure 11 (for one of the eye-pieces) permits of forming the chills **3***a* and **4***a* of two principal pieces abutting together according to the symmetry plane of the mask. This device comprises, for each eye-piece, a steel casing **64** which is secured in a corresponding recess of the chill proper (as, for instance, **3***a*) and a core **65**. The contact surface **65***a* of the core **65** and of the casing **64** shows a conicity corresponding to an angle which is so great that it permits of without counter-draw, the separation of the pieces during the withdrawing from the mould which is effected through a relative displacement of the chill **3***a* and of the head **11** according to the arrows *f*, the core **65** remaining fast with the head with the body of the mask. Once the head **11** completely disengaged and the mask stripped from this head, it is sufficient to expel the core **65** outwardly. At **66** is shown the ring to the eye-piece which shows a conical part **66***a* which, during the preparation of the mould, adjusts itself in a corresponding recess of the casing **64**.

For the direct fastening of each buckle for fastening the mask on its body, the chill **3***a* (what is said here for this chill applies also to the

chill **4***a*) is provided (Figures 12, 13 and 14) at each suitable place with a recess **72** in which a set of two small plates **73—74** is located which rest against one another. The small plate **73** comprises a part **73***a* which extends downwards until the inner surface of the chill **3***a* between the two legs **74***a* and **74***b* of the small plate **74**. The lower face of this small plate **74** thus forms an extension of the inner surface of the chill **3***a*. The small plate **74** is provided with a hollowed part **74***c* designed for receiving and clamping the buckle **75** in combination with a corresponding hollowed part **73***c* of the small plate **73**. The recess **76** which is thus formed between the small plates **73** and **74** is filled up by the molten rubber when the latter rises into the said recess under the action of the pressure. As the leg **75***a* of the buckle extends through this recess, the said leg is entirely surrounded with rubber after the formation of the mask, which rubber forms an extension of the mask proper **11***c* and thus connects the leg **75***a* with the said mask. The leg **75***a* of the buckle will be provided, or not, at the place where the rubber is to surround it, with a fabric prealably impregnated with a rubber solution or a solution of equivalent products. For stripping from the mould the jaws are opened and the small plates **73—74** carried with the mask move away from their recess in the chill **3***a*, the resting surfaces of the said small plates in the said recess showing a direction which is suitable for readily permitting of this disengagement because it has no counter-draw. Then the small plate **73** is drawn out and the small plate **74** is pulled in the direction of the arrow *fa* after the buckle **75** has been raised.

For securing the fastening buckles provided on the edges of the body of the face-cover, a device such as the one shown in Figures 15 and 16 can be used. This device is generally identical with the preceding one with the exception that the upper small plate (here **73'**) which encloses the buckle and forms the mould for the rubber at **76**, is hinged on the lower small plate **74'**. As shown in Figures 15 and 16 the operation to be effected consists in securing to the mask a hook **77** the portion **78** of which will be brought down after the moulding of the mask. The lower small plate **74'** inserted in the head **11** is recessed for receiving the buckle **77** and for forming at **81** the other part of the mould for the rubber **82**; on the part **83** is pivotally secured by two ears the upper small plate **73'**. The latter is recessed for giving way to the raised part **78** of the hook. The recess is large enough for permitting the small plate **73'** of rocking about the stud **86** without fouling the hook **78**. Elastic pins such as **87** ensure the locking of the upper small plate **73'** against the lower small plate **74'**. The whole is maintained in its position by the chill **3***a* or **4***a* which rests on the upper small plate. During the moulding of the mask the rubber enters at **82** the space **76** and surrounds the leg **88** of the hook. When the piece is a flat buckle it is not necessary to provide a recess in the upper small plate excepted eventually for the discharge of the excess of rubber.

In another form of execution a cavity **89** can be provided in the lower small plate **74'**, this cavity being able to form a release chamber for the rubber and to prevent the latter of forming, by moving the small plates **73'** and **74'** away from another, a rubber wall which it would be difficult to remove.

It is to be noted that it would be possible, without departing from the scope of the present invention, to operate the above mentioned devices by using, for forming the mask, instead of rubber sheets, rubber or any other natural or synthetic plastic material injected under pressure into the interval provided between the head and the chills, the jaws being prealably brought together and maintained simply closely pressed against one another by a suitable locking device.

EMILE JEAN ALBERT LEJEUNE.

PUBLISHED

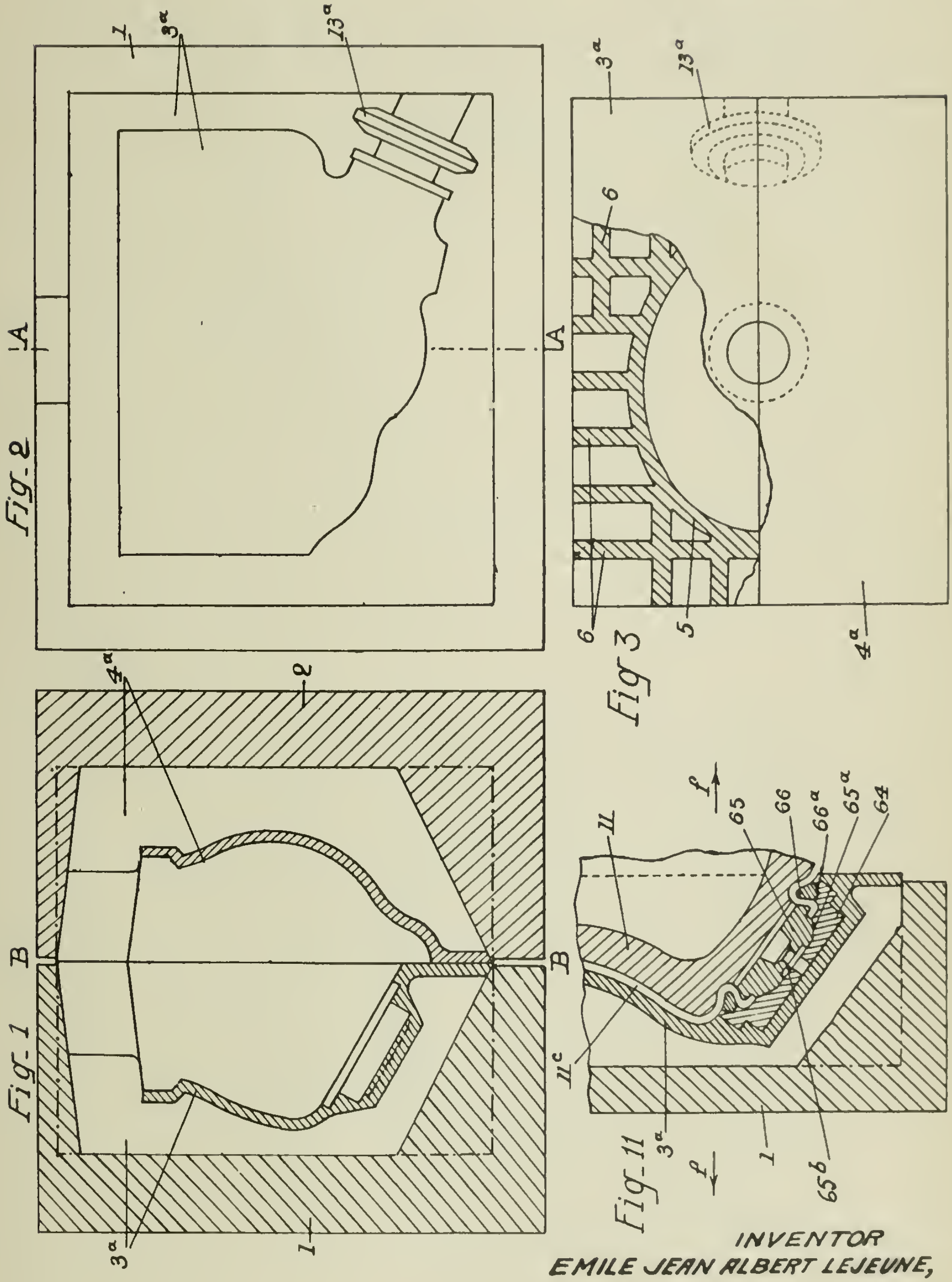
APRIL 27, 1943.

BY A. P. C.

E. J. A. LEJEUNE
POCESS AND DEVICE FOR THE
MANUFACTURE OF GAS MASKS
Filed Nov. 16, 1939

Serial No.
304.867

6 Sheets–Sheet 1



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PUBLISHED

APRIL 27, 1943.

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MANUFACTURE OF GAS MASKS
Filed Nov. 16, 1939

Serial No.
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6 Sheets-Sheet 2

Fig. 4

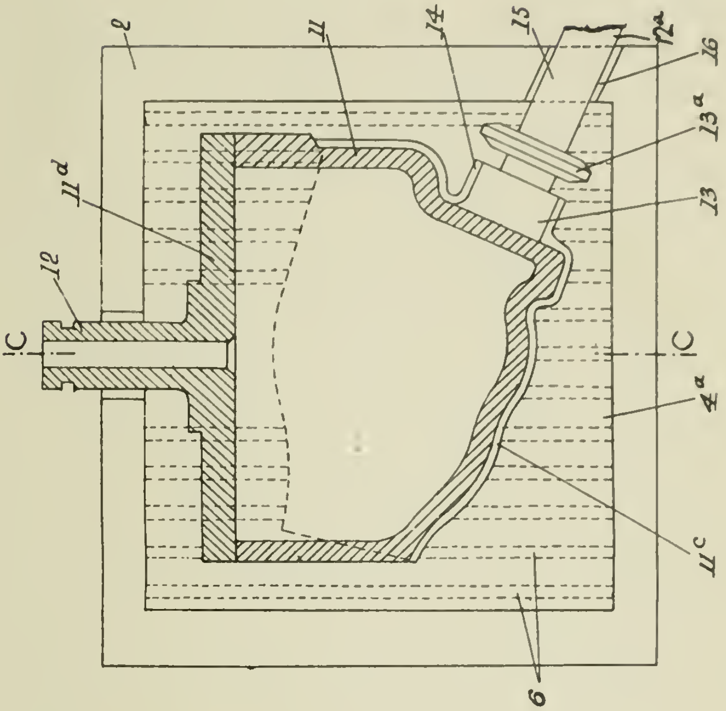
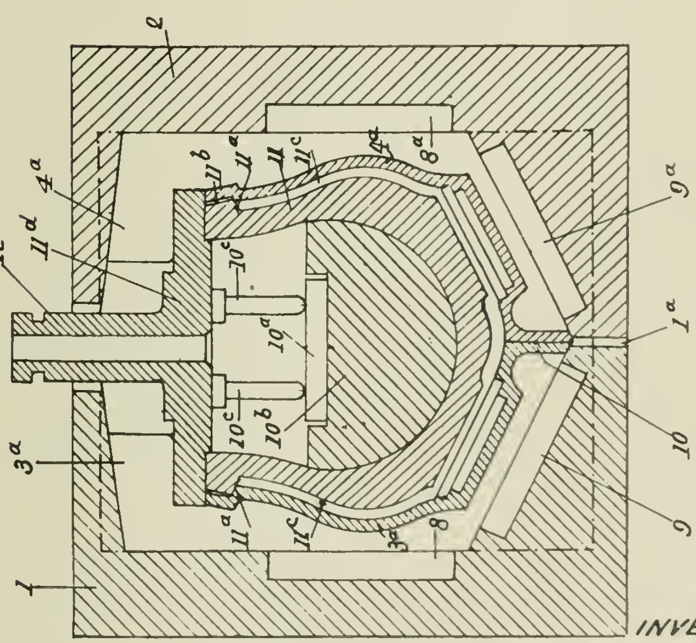


Fig. 5



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MANUFACTURE OF GAS MASKS
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304.867

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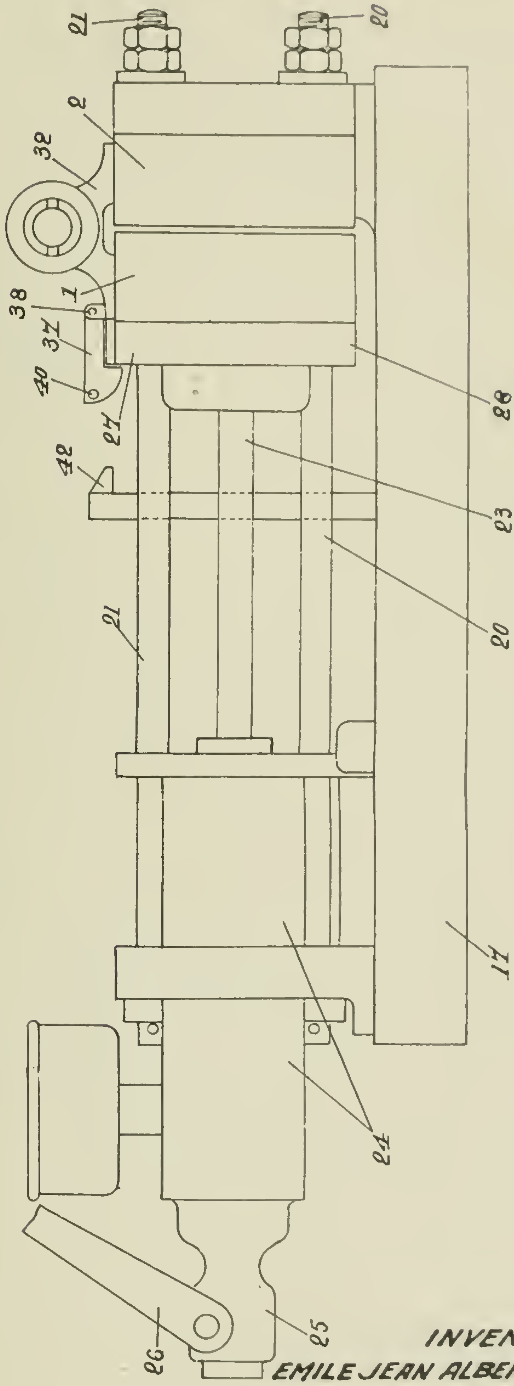
Fig. 6



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PUBLISHED
APRIL 27, 1943.
BY A. P. C.

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MANUFACTURE OF GAS MASKS
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Fig 7

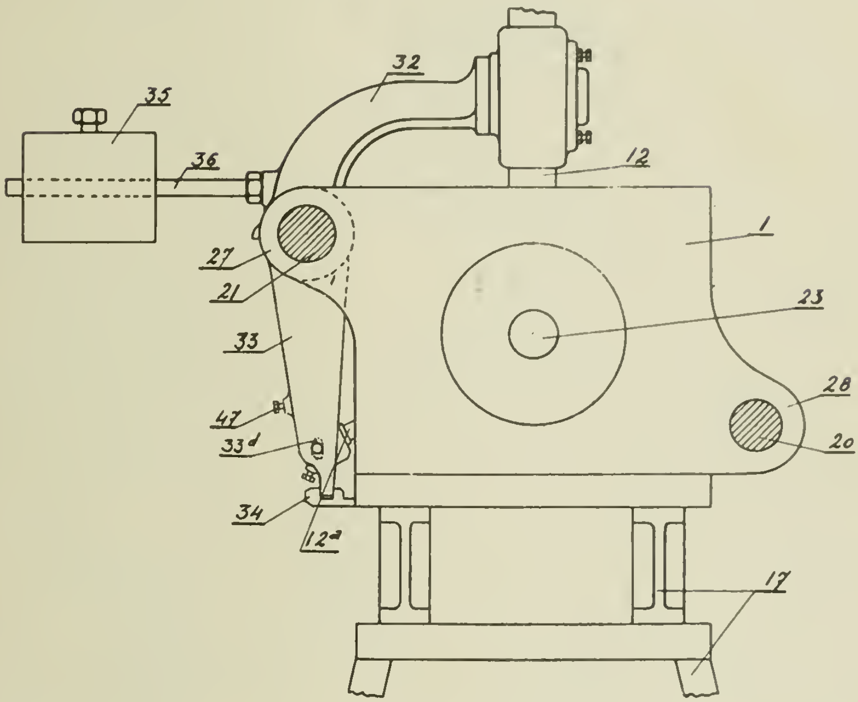
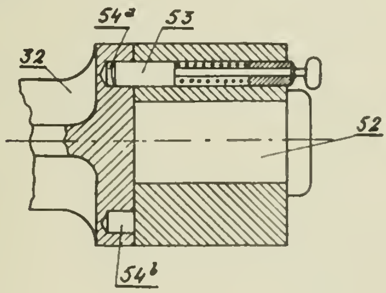


Fig 10



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PUBLISHED

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POCESS AND DEVICE FOR THE
MANUFACTURE OF GAS MASKS
Filed Nov. 16, 1939

Serial No.
304.867

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Fig 9

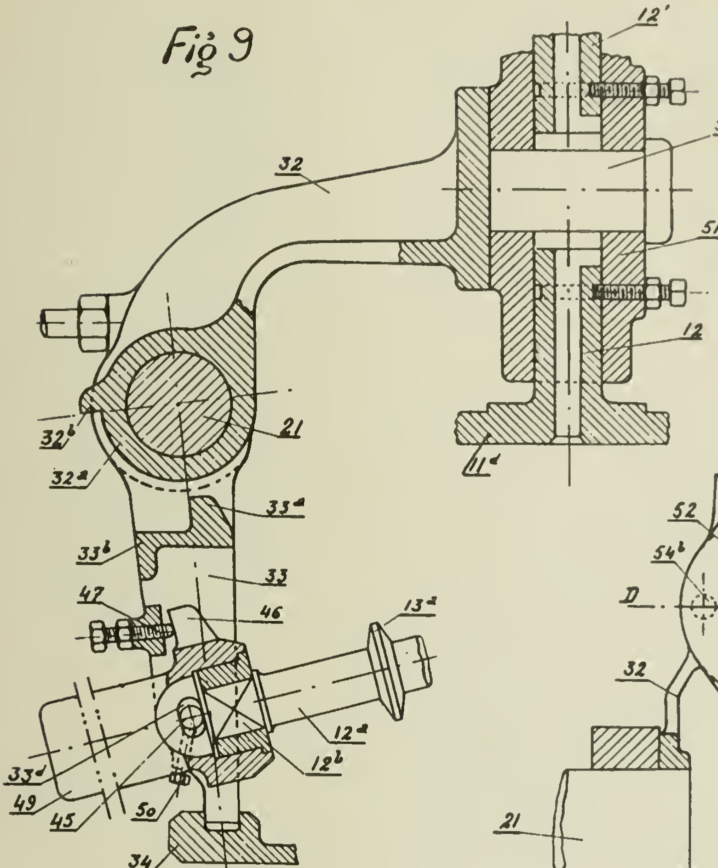
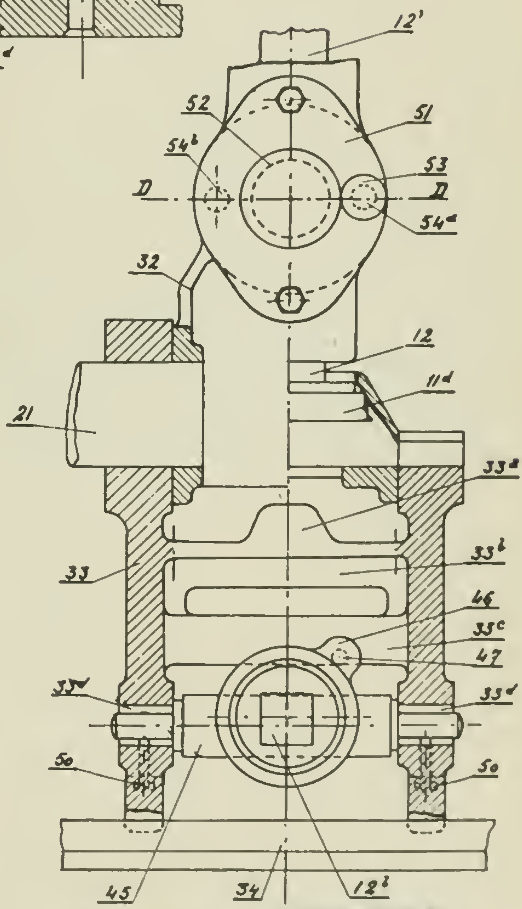


Fig 8



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PUBLISHED

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BY A. P. C.

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POCESS AND DEVICE FOR THE
MANUFACTURE OF GAS MASKS
Filed Nov. 16, 1939

Serial No.
304.867

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Fig.12

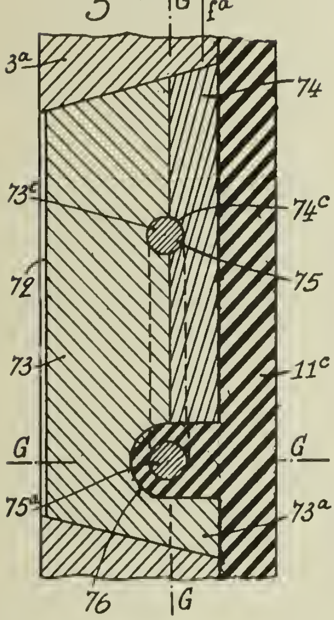
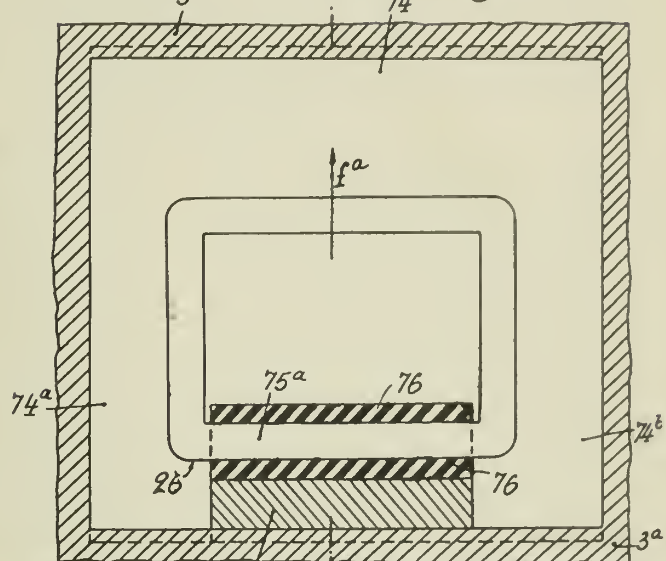


Fig.13



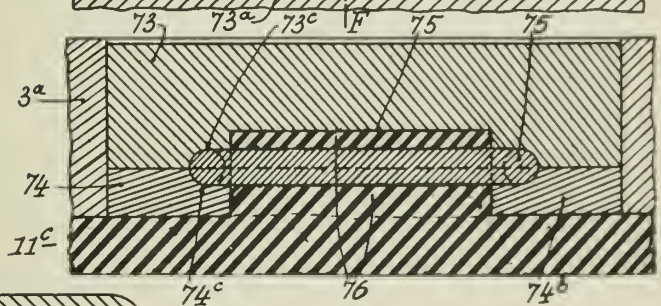


Fig.14

Fig.15

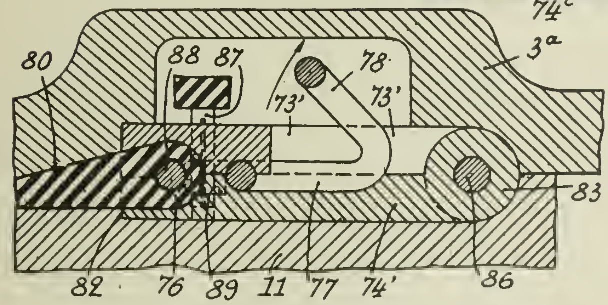
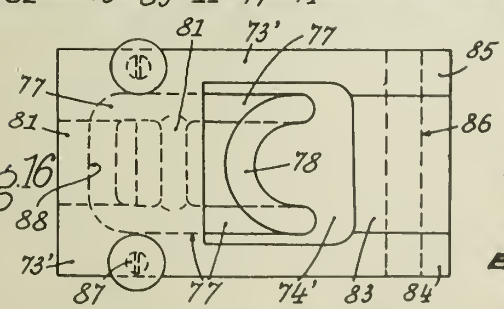


Fig.16



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Published Apr. 27, 1943 Serial No. 306,071

ALIEN PROPERTY CUSTODIAN

PROCESSES FOR THE MANUFACTURE OF AMMONIUM NITRATE

Giacomo Fauser, Milan, Italy; vested in the Alien Property Custodian

Application filed November 25, 1939

It is known that the utilisation of the reaction heat in the manufacture of ammonium nitrate encounters considerable difficulties owing to the tendency of nitric acid to volatilization, so that considerable nitrogen losses occur, as soon as the boiling temperature is reached, if ammonia is introduced into nitric acid without special precautions.

In order to avoid similar losses it has already been proposed to operate the reaction between acid and ammonia at a higher pressure than that corresponding to the boiling temperature of the ammonium nitrate solution produced. This solution is then discharged into another vessel, outside and under atmospheric pressure, where it is evaporated by means of the heat developed by the reaction itself. This working scheme is however connected with the disadvantage to require the compression of nitric acid and of ammonia. It has also been proposed to operate the neutralisation of acid and of ammonia under atmospheric pressure and to use the reaction heat to concentrate the solution in a vacuum evaporator, but this process causes a considerable complication because of the necessity to provide for the vacuum and to condense the whole amount of vapour produced from the solution, that which means a large consumption of cooling water.

My invention, on the contrary, allows to utilise the heat produced by the reaction of ammonia with nitric acid to concentrate the ammonium nitrate solution without being compelled to use a saturator under pressure and without condensing the vapour under a vacuum.

The principle of my new invention is still that to cause the neutralisation of nitric acid with ammonia to take place under a higher pressure than that of the vapour tension of the solution formed, while evaporation is carried out under atmospheric pressure, but the difference in pressure is given by the height of the liquid column contained in the saturator.

The annexed drawing shows a scheme of the apparatus. Nitric acid and ammonia are sent in the proportions required by the reaction through coils 1 and 2 into the heat exchangers 3 and 4 where they are preheated at the expense of the vapour coming from the concentration of the nitrate solution obtained. Then ammonia is introduced into the lower part of the saturator by means of distributor 5, while nitric acid is injected into the central pipe 6. The heat developed by the reaction causes the temperature of the solution to rise up to the boiling temperature; for instance, if a concentration of 90% is required, the solution at the surface of the bath boils at 148° C. If the height of the liquid in the saturator is 4 m., the pressure at the bottom is 0.55 atmospheres correspondent to a boiling temperature of about 157° C. In order to avoid any loss of ammonia and nitric acid, it is necessary that the evaporation of the solution be started only when neutralisation is complete ultimated and therefore the temperature in the lower part of the saturator where nitric acid and ammonia is injected must be maintained below 157° C. This condition is obtained by an intensive circulation of the liquid in the direction shown by the fleshes, so that the solution of the upper part of the saturator, where temperature is maintained at 148° C. owing to the evaporation of water is sent back through the annular space 7 into the lower part, securing thus the temperature to be kept within the limit desired.

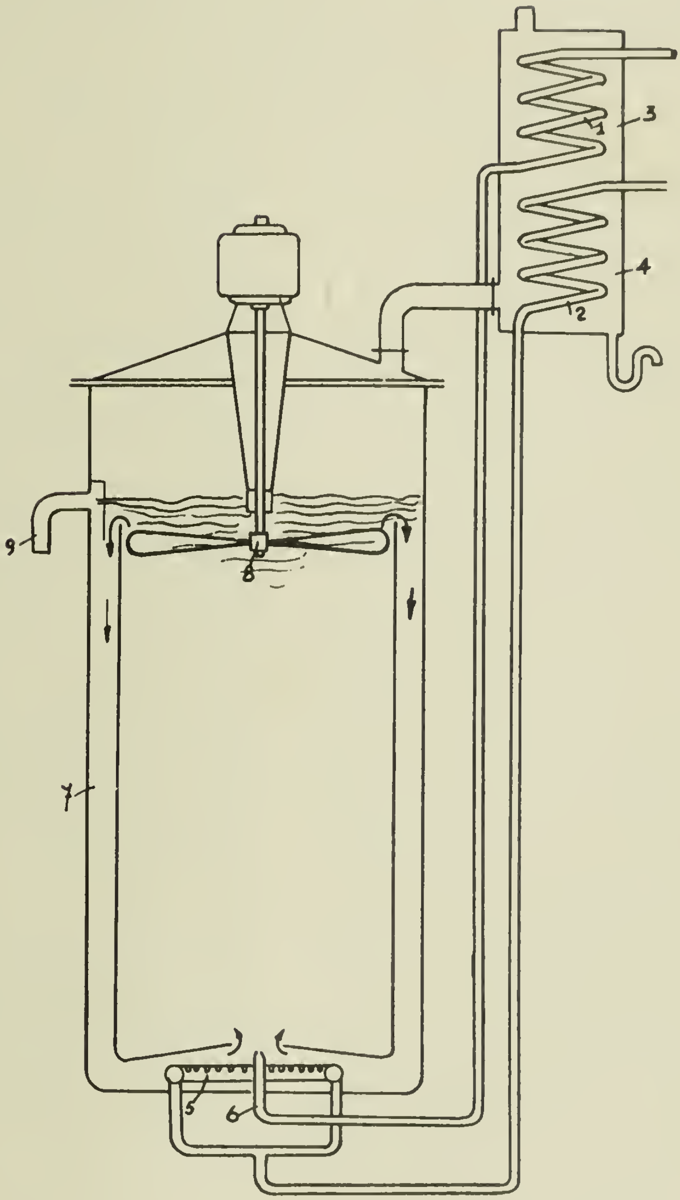
The circulation of the liquid is operated by a helix on vertical shaft 8, which takes therefore the place of a circulating pump. When the solution reaches the higher part of the saturator and begins to boil owing to the lower pressure, it is already completely neutralised, so that no loss of nitrogen takes place. The concentrated solution issues from the saturator by means of pipe 9.

GIACOMO FAUSER.

PUBLISHED
APRIL 27, 1943.
BY A. P. C.

G. FAUSER
PROCESSES FOR THE MANUFACTURE OF AMMONIUM NITRATE
Filed Nov. 25, 1939

Serial No.
306,071



INVENTOR
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Published Apr. 27, 1943

Serial No. 306,443

ALIEN PROPERTY CUSTODIAN

COOKING-UTENSIL

Tjien To Oey, Semarang, Java, Netherlands East Indies; vested in the Alien Property Custodian

Application filed November 28, 1939

The present invention relates to a method by means of an improved steam cooker for the cooking of food in a general sense, and belongs to that kind of cooking apparatus, heretofore used, whereby the food to be cooked is placed within the cooker, the top or cover is held to the vessel and a relatively small vent is made through the cover from which vapor constantly escapes during the cooking process, the interior of the vessel being at atmosphere pressure or a little above it. Many of such apparatus are known, though none of them is constructed in such a manner as to give automatically warning when the food is done.

A characteristic of the construction according to the invention is, that a signal is brought into action after the food has been boiling for a certain length of time in the steam bath. This characteristic consists in the lowering of the level of the liquid, caused by the boiling down of the water after some fixed time.

The advantage obtained by application of this cooking apparatus is, that the length of cooking is not left to the personal opinion of the cook, who mostly only guesses that length, thus causing the food to be too hard or too soft. By this method every table can be provided with well-cooked food, while during the cooking other work may be performed as the whistle will warn directly the food is ready.

As an illustration of the invention some constructions are shown, by way of example and schematically, on the accompanying drawing.

Fig. 1 shows the cross-section III—III of Fig. 3.

Fig. 2 shows the cross-section IV—IV of Fig. 4.

Fig. 3 shows the cross-section I—I of Fig. 1.

Fig. 4 shows the cross-section II—II of Fig. 2.

Fig. 5 shows the view of the cooking apparatus according to Fig. 6, embodying the present invention.

Fig. 6 shows a section of the cooking apparatus according to Fig. 5.

In this figure, 1 shows the cooking apparatus, on which fits a detachable lid 2. This lid contains an opening 3 with chimney 4. This lid, which is constructed rather heavy, is placed on the cooking basin by way of packing or trimming, allowing no steam to escape.

The purpose of this steam-basin is to subject the space, in which the pans 5, containing rice or other food, is placed, to a small excess pressure of steam.

When the apparatus is used a certain quantity of water is put in cooking basin 1, for instance till dash A. This quantity depends on the size of the basin and the cooking time of the food that is to be steamed. Subsequently the ring 20 is put in the basin, which ring is provided at top and bottom with openings 21. These openings are necessary to allow the formation of steam within the ring, to be released under the pan that rests upon it. This ring is constructed with a high wall with the purpose of keeping the pan above the waterlevel in basin 1.

In consequence hereof the pans are, during the cooking, only in a steam bath. The pan is marked 5 and in the drawing it is drawn free from the ring. The pans can be kept above the waterlevel in another way, for instance by a ring that is fixed at the wall etc. At the upper brim the pans have a row of openings 22. These serve to constitute a connection between the space of cooking basin 1 and the contents of the pans, when a greater number of pans are placed upon each other.

First the food or a certain quantity of rice is put in the pan, together with a certain quantity of water. As a result of the pan being completely closed at the bottom side the water, in which the food is cooked, cannot flow away, so that all nutritious matter remains in the food. For vegetables, fish and meat it is not even necessary that any water is added.

Dependent on the source of heat more or less steam will be developed and in the same degree the escape of this steam from the pan will vary. Besides gas and electricity also that fuel can be used as source of heat which is commonly used by natives as wood, charcoal, moss, etc. When this fuel is used, however, the source cannot be regulated as when gas is used. Dependent on the source of heat the escape of steam through the chimney can be regulated as the case may require. The comparative heavy lid serves then as a safety valve.

The purpose of keeping a slight excess-pressure in the cooking basin serves in the first place as a security for keeping the food in a steam bath, and secondly to accommodate the varying cooking time in case the source of heat does not yield a constant heating.

It stands to reason that the time needed for cooking depends on the source of heat; with a big fire the evaporation of the water will be much quicker than with a small fire. As, however, the temperature of the steam in the cooking basin is slightly increased with a big fire a compensation is obtained for the shorter period. In spite of the shorter period the food gets done just as well. With the sources of heat as applied in the house-

hold the variations in the cooking periods usually remain very small, as a rule not exceeding 5 minutes, which cannot be of any great importance regarding the final result.

The cooking basin can be connected with a space, f.i. a cylinder 9, at two places 7 and 8, in which cylinder a boiler 10 is inserted, that is open at either side, and that terminates at the lower end at a certain distance from the bottom. The opening 8 is very small and is preferably applied in a lid that closes the larger passage 12 between basin 1 and cylinder 9, which passage serves to enable the cleaning of the cylinder 9. Opening 8 was kept very small to guarantee a quiet waterlevel in cylinder 9. On top of cylinder 9 an alarm device 13 can be fixed of which 14 shows the hole of the whistle. The space of 13 is connected with the space of boiler 10.

When the cooking apparatus is put on the fire the water at the height of A will shut off the boiler 10, which is freely connected with cooking basin 1 via 8 and 9, from the bottom. After a lapse of a certain time the waterlevel in basin 1, together with that in cylinder 9, will be fallen so low that boiler 10 is no longer shut off by the water with the result that the steam can also escape through this boiler. The waterlevel has sunk then till B and after this has taken place also the alarm signal is brought into action, giving warning that the food is ready and that the source of heat may be extinguished.

For reasons of symmetry an installation 15 is applied to the other side of the cooking basin, at which is suspended, by means of a hook and eye, a movable arrangement 16 which has a continuation in a small hafting 17. Basin 1 also has, at the lower side, a circular bracket 19 with a hafting 18. The purpose of this arrangement is to control the vertical position of the basin on the source of heat, on which position the function of the cooking basin largely depends. The cooking time adjusts itself, as is evident. to the level of liquid with regard to the bottom side of 10. When the cooking basin does not rest vertically on the fire the cooking period will be either too long or too short.

The arrangements 15 and 9 may also be used as handles, though separate handles may be applied. Also on the lid some grip or handle can be fixed.

Independent from the size of the fire the food is cooked when the alarm gives warning.

Experiment proved that several foods, as fish, meat, vegetables etc. can be cooked in the same time as rice. When more pans are used on top of each other they can contain several foods (see fig. 1). If, however, the pans contain foods that require different cooking-times, then more cylinders 9 with boiler 10 may be applied, each one having its own alarmwhistle, so that for each kind of food special warning is given when they are ready. Boiler 10 may also be slid into cylinder 9. When the first warning is given that the contents of a pan are ready, this pan can be taken out of the basin after which the basin is closed again. Boiler 10 is inserted lower into cylinder 9 and one has only to wait for the second warning.

Another construction according to the invention is given in fig. 2. By this method the lower end of the boiler 10 is led to the centre of the cooking basin where, between the mouthpiece of boiler 10 and cooking basin 1, a partition is placed by way of a lid 11 or in any other way, in which partition a small hole 8 is cut. This hole serves again to keep the waterlevel in the vicinity of the end of boiler 10 as quiet as possible. The advantage of this construction is, that the vertical position (16. 19, see fig. 1) of the cooking apparatus can be neglected, while the cooking basin always will have a vertical position on the source of heat, and minor deviations, in the centre of the basin, are of no practical significance.

Boiler 10 can, however, also be constructed without boiler 9, either at the side or in the basin 1.

Another construction according to the invention by which the cylinder 9 and the boiler 10 are partly executed inside the basin is given in figs. 5 and 6. Fig. 5 being an outside view of the cooker in fig. 6. In this figure 6, just like in fig. 2, the opening 3 pass into a stop-cock by which the escape of steam from the basin may be varied. The cylinder 9. inside the cooker, is provided with passages 26, allowing steam to enter within it. In this way, when the boiler is no longer shut off by the water, a sufficient quantity of steam can escape through the boiler 10, bringing the alarm signal into a firm action. Preferably a horizontal cylinder 9 is applied getting a quiet waterlevel round the inlet of boiler 10.

In this way the length of cooking or steaming is fixed by the apparatus itself.

Other advantages may be mentioned:

The cooking apparatus is simple of construction and can be sold at a cheap price, thus facilitating its distribution especially among natives.

The cooking apparatus does not possess any movable parts, so that the upkeep does not incur any extra expences.

The invention is not restricted to the construction as shown in the drawing. It is possible to find other solutions within the scope of the invention. f.i. for the working of the alarm-arrangement; in cylinder 9 an enchaser might be inserted instead of boiler 10, in such a way as to shut off the eduction-opening for the steam to the larm-arrangement, till the waterlevel is sunk so low that the enchaser opens the steam valve.

TJIEN TO OEY.

PUBLISHED

APRIL 27, 1943.

BY A. P. C.

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COOKING-UTENSIL

Filed Nov. 28, 1939

Serial No.
306,443

FIG. 5

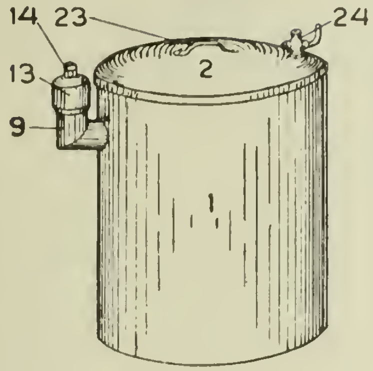


FIG. 6

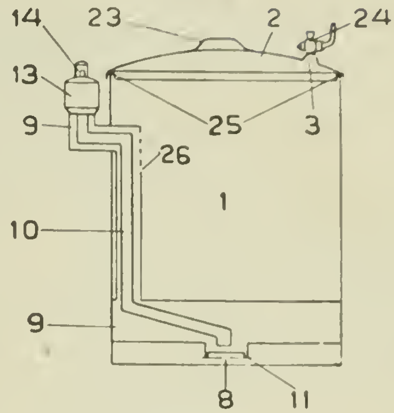


FIG. 3

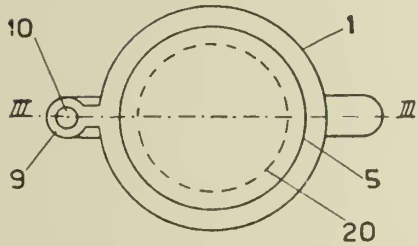


FIG. 4

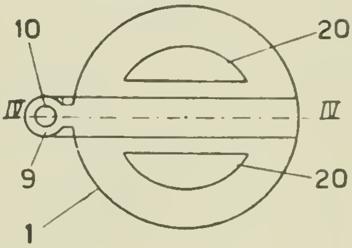


FIG. 1

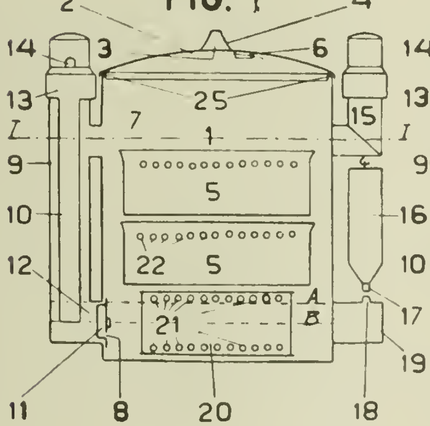
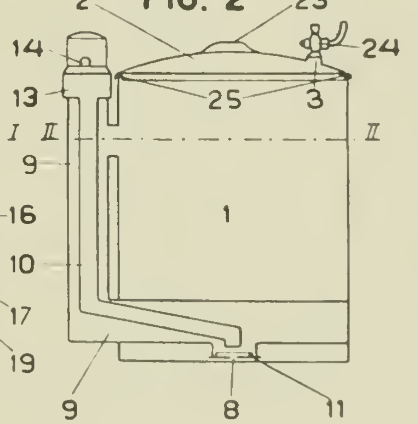


FIG. 2



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Published Apr. 27, 1943

Serial No. 306,568

ALIEN PROPERTY CUSTODIAN

AUTOMATIC SHOOTING GUN WITH ONE BARREL, TWO DISTINCT MAGAZINES FOR CARTRIDGES AND A DEVICE FOR SELECTING SAID MAGAZINES

Goffredo Prola, Rome, Italy; vested in the Alien Property Custodian

Application filed November 28, 1939

The present invention relates to an improvement for an automatic shooting gun and regards properly a new automatic shooting gun. This gun being provided with two magazines of independent cartridges for the shots successive to the first allows the hunter to have at his disposition cartridges of different characteristics (for instance as to thickness of the lead) so that he may decide at the moment of firing which of these cartridges has to be introduced into the barrel for the subsequent shot. In other words with this gun which may fire three or more shots the hunter can when firing the shot in the chamber, decide which cartridge of the one or the other magazine has to be introduced for the subsequent shot when the first shot had missed the mark, so that in such a way the type of the cartridge may be adapted to the game to be aimed at.

This automatic gun with a full recoil of bolt and barrel has besides the important advantage that the cartridges to be introduced in the barrel may be chosen on the spot owing to its determined characteristics: (1st) a finer shape than the other guns of the same kind; (2nd) a more stable equilibrium since the cartridges are subdivided in two magazines one forward, the other backward the centre of gravity of the arm; (3rd) the possibility of being easily inspected and cleaned in all its parts.

The gun comprises the following main parts: a barrel, a bolt, a sear and striking mechanism, two tubular magazines for reserve cartridges; a preselecting device controlling the clearing of the cartridges out of the two magazines independently one from the other according to the choice of the marksman; an elevating device for elevating the cartridges to the orifice of the explosion chamber; a central body or frame conveniently holding together the different pieces; a protecting cover for the bolt and motion; a protecting cover of the device controlling the clearing of the cartridges out of the two magazines; a butt; a rod.

The movements automatically occurring at each firing when the trigger is pulled down are the following:

(1) Unhooking of the striker, percussion and ignition of the copper cap and firing of the cartridge being inside the barrel; at the same time with the unhooking of the striker a lever is displaced, which, as explained further on, predisposes which of the two magazines will furnish the cartridge for the subsequent shot.

(2) Recoil of the bolt entraining the barrel hooked thereon; blocking of the striker disengaging control.

(3) Stopping of the recoiling mass at the end of the recoil stroke, hooking of the bolt.

(4) Unhooking of the barrel, cocking of the striker, blocking of the catch, forward return of the barrel, expulsion of the fired case and clearing of the cartridge of one of the two magazines.

(5) Displacement of the cartridge cleared out of the magazine above the elevator, unblocking of the elevator.

(6) Elevation of the cartridge through the elevator to the opening of the firing chamber; unhooking of the bolt.

(7) Return of the bolt forwards, introduction of the cartridge into the firing chamber; lowering of the elevator; unblocking of the catch hooking again the bolt on the barrel; unblocking of the striker releasing control.

The gun is ready for a new shot.

According to a further form of realisation of the present invention, in which the striker is cocked during the recoil stroke of the bolt and not during the forwardstroke, the movements automatically occurring in this case at each firing by pulling one of the triggers are the following:

(1) Unhooking of the striker, percussion and ignition of the cap, firing of the cartridge in the barrel; simultaneously with the releasing of the striker there is a displacement of the lever predisdosing, as furtheron explained, which of the two magazines will furnish the cartridge for the subsequent shot.

(2) Recoil of the bolt entraining the barrel hooked therein; cocking and blocking of the striker.

(3) Stopping of recoiling mass at the end of the recoil stroke; hooking of the bolt.

(4) Releasing of the barrel; blocking of the lock, return of the barrel forwards; expulsion of the case fired and clearing of a cartridge out of one of the two magazines.

(5) Displacement of the cartridge cleared out of the magazine above the elevator; unblocking of the elevator.

(6) Elevation of the cartridge by means of the elevator as far as the opening of the firing chamber; unhooking of the bolt.

(7) Return of the bolt forwards; introduction of the cartridge into the firing chamber; lowering of the elevator; displacement of the group striker and sear control device hooked thereon; releasing of the lock hooking again the bottom of the barrel.

The gun is ready again for firing.

The present invention is here illustrated and described with reference to the accompanying

drawing in two forms of realisation, but it is understood that constructive changes may be introduced therein without surpassing the limits of protection according to the present industrial patent. Particularly though a gun with two triggers, the invention may be realised with a gun with only one trigger, the preselecting member mentioned being in such case controlled by a convenient member accessible to the hands of the rifleman during firing, for instance a knob or a lever. Furthermore it is not indispensable that the magazines are disposed one forward, the other backward the elevator, both may be on the front or on the back, one on the side of the other or one over the other provided both may feed at choice the elevating device of the arm. This expression "elevating device" means not only the normal mechanism raising (downward upward) the cartridge bringing the same in correspondence to the bolt or the breech of the arm but any other equivalent mechanism capable of taking a cartridge out of one of the magazines and bringing it with a transversal, longitudinal, translatory, rotatory motion and the like in such a position as to be introduced into the breech chamber.

Among the different possible forms of realisation mentioned, the one has been preferred in which the two magazines are tubular and disposed one on the front of the elevating device, under the barrel and parallelly thereto, the other on the back of said device inside the butt assuming in this case a rather curved shape to be adapted to the inclination of the butt as regards the axis of the barrel. This disposition allows a very good balance of the gun, a minimum encumbrance, a better disposition of the mechanisms and a pleasant external shape of the arm.

According to the present invention the firing and preselecting device is totally enclosed in a thin side chamber of the frame of the arm, covered by a small plate, all the parts of the mechanism being easily inspected or dismounted when this plate is removed. This disposition constitutes a characteristic of the present invention.

The invention is illustrated, as already mentioned, in the accompanying drawing in which:

Fig. 1 is a side view in elevation of an automatic shooting gun with only one barrel and two magazines for cartridges, according to the invention.

Fig. 2 is a vertical, longitudinal axial section in a larger scale of the arm shown in Fig. 1 with some parts omitted for clearness sake. The parts are illustrated in the position of the gun ready for firing. The bolt is illustrated according to a first form of realisation.

Fig. 3 is a plan view and in partial section corresponding to Fig. 2.

Fig. 4 is a horizontal section according to line IV—IV of Fig. 2 and illustrates some details.

Fig. 5 illustrates the position assumed by some parts of the feeding device of the arm after actioning the trigger predisposing the advancing of a cartridge from the front magazine to the elevating device.

Fig. 6 shows the same parts as Fig. 5 after actioning the trigger predisposing the feeding from the back magazine.

Fig. 7 shows the same parts of Figures 5 and 6 after actioning the trigger predisposing the feeding of the front magazine when in this magazine no cartridge is to be found;

Fig. 8 shows in a plan view the mechanism of the triggers of the arm with some parts omitted for clearness' sake.

Fig. 9 is a vertical section according to line IX—IX of Fig. 2 and illustrates in a front elevation the mechanism of the triggers;

Fig. 10 is a plan view of the rocking lever with vertical axis of oscillation serving for the preselection of the two magazines under the action of said triggers;

Fig. 11 is a detail of the preselecting mechanism controlled by the triggers in a perspective view;

Fig. 12 is a vertical longitudinal section of the arm illustrated in Fig. 2 with some parts omitted, with the object of showing the cartridge elevating device;

Fig. 13 is a plan view of a first form of realisation of the bolt as already illustrated in Fig. 2

Figs. 14 and 15 are respectively a side elevation and a back elevation, view of the bolt illustrated in Fig. 13.

Fig. 16 is a vertical transversal section according to line XVI—XVI of fig. 13.

Fig. 13*a* illustrates schematically a second form of realisation of the bolt;

Fig. 17 shows a right-hand side elevation of the breech of the moveable barrel illustrated in the preceding figures;

Fig. 18 illustrates in a partial view and in a turned up plan view the breech shown in fig. 17.

Fig. 19 shows schematically the engagement between the tail of the breech and the cartridge-bottom kept in the bolt by means of the pawls of the extractor;

Fig. 20 is a view in elevation of the breech back illustrated in fig. 17.

Fig. 21 is a section according substantially to line XXI—XXI of fig. 2 with parts omitted for clearness' sake and illustrates a modification of the cocking and releasing device of the striker;

Figs. 22—23—24 illustrate some details relating to the cocking and releasing device of the striker shown in fig. 21.

Figs. 25—26—27 illustrate in a left-hand side elevation, in a backward and right-hand side elevation the rotatable lock of the bolt.

The invention will be now described with reference to the form of realisation of figures from 1 to 20.

The shooting gun subject matter of the invention, fig. 1, comprises a single barrel **1** sliding on the gun stock **2** ending in a butt **3**. This butt **3** is provided downward with two triggers **4**, **5** and when these are actioned on, the shot already in the barrel is fired and simultaneously the feeding mechanism is predisposed for the advance of a cartridge from the front magazine **6** or from the back one **7** according to which trigger has been operated on. A plate **8** sliding in the left-hand wall **9** of the stock **2** covers and protects the preselecting mechanism of the cartridges while an anterior prolongation **10** of said stock **2**, preferably of wood, is hollow and receives the front magazine **6** of the cartridges and the recuperating spring **11** of the barrel.

On the side of the stock **2** there projects the knob **12** of the safety device. The anterior prolongation of the stock **2** is held in position by means of a roughened knob **13** screwed on a prolongation **14** of the front magazine **6**. This latter of a cylindric shape on the outside constitutes simultaneously a guide for the sleeve-like lug **15** of the barrel **1**, against which lug operates the recuperating spring **11** mentioned.

The other end of the spring **11** bears against the anterior face **16** of the stock **2**.

The stock **2** is totally hollow and contains the whole charging and firing mechanism of the arm. On the top it is closed by a cover **17** which covers and protects the breech of the barrel and the bolt, these parts not being illustrated in fig. 1. The cover **17** is anteriorly provided with a flat vertical lug **18** lodged on the anterior face **16** of the stock **2** and constitutes in its turn a support for the anterior prolongation **10** of the stock **2**. Said prolongation **10** is pressed against said lug **18** by means of said roughened knob **13**.

With reference now to figures 2—3—4 the barrel **1** is posteriorly provided with a sleeve **19** screwed in **20** on the posterior end **21** of the barrel **1**. The sleeve **19** (see also figs. 17—18—19—20) is provided with a posterior superior lug **22** with an eye-hole **23** in which engages the tooth **24** of the rotatable lock **25**, more particularly described furtheron with reference to figures 25—26—27. The lug **22** is posteriorly provided with two teeth **26** and **27** capable of cooperating with the tooth **28** of the extractor provided on the bolt **29** for the expulsion of the case **30** (figures 17—18—19—20). The sleeve **19** has furthermore an inclined surface **31** (figures 17—18—20) destined to cooperate with the rocking lever **32** of the bolt **29**. The functioning of these parts is explained furtheron.

The sleeve **19** is finally provided with two inferior slideshoes **33** and **34** sliding in the guiding grooves **35** and **36** (fig. 9) obtained inside the gunstock **2** to direct the barrel while longitudinally sliding.

The wooden prolongation **10** covers and protects, as already mentioned, the lug **15** of the barrel **1**, the recuperating spring **11** and the front or anterior magazine **6**. Anteriorly it ends with a thick wall **37** (fig. 1) constituting a stop for the forward stroke of the lug **15** and barrel **1**.

The bolt **29** comprises a block provided with the following pieces: two teeth **28** and **38** pivoting in **39** and **40** and strained by springs **41** and **42** said teeth forming the device for extracting the cartridge from the barrel; a lock **25** (see also figs. 25—26—27) with circular motion around a centre of rotation **43** (fig. 14) determined by the cooperation of the pivot **44** with a cavity **45** provided on the right side of the lock **25**. This latter has the object of hooking the bolt **29** on the barrel **1** by engaging its tooth-shaped lug **24** into the eye-hole **23** of the posterior prolongation **22** of the sleeve **19**. As already mentioned the sleeve **19** is solidary to the threaded back end **21** of the barrel **1** by screwing.

The bolt is further provided with the said lever **32** for blocking the lock (figures 15—16—17—18). The rocking lever **32** is fulcrumed in **45** and by its back and **46** tends to be engaged in the cavity **47** provided in the left side of the lock **25** by means of a spring not illustrated for clearness' sake. The rocking lever **32** serves to block the lock when this is completely slipped into the bolt.

In the right side of the bolt **29** slides a body **48** controlled by a catching member **49** in which engages the finger of the person using the arm in order to obtain the running backwards of said sliding body **48** against the action of a spring (not illustrated) operating on the transversal lug **50** of said sliding body **48**.

The sliding body **48** acts, by means of the pivot **44** on the lock **25** disengaging the same from the eye-hole **23** of the tail **22** of the breech of the barrel **1**.

The striker **51** (Fig. 13) is illustrated in the cocked position with dash lines and indicated by reference number **51'**. The striker is strained to advance by a spring **52** and is carried by a moveable body **53** which in the return stroke forward of the bolt **29** engages with the projection **54** of a tooth **55** carried by a swinging lever **56** (see Fig. 2). The spring **52** (Fig. 13) bears posteriorly against the lug **57** of the sliding member **48** which in Fig. 13 is indicated in the back position by reference number **48'**. The snapping forward of the striker to hit the cap of the cartridge through the hole **58** of the bolt **29** is determined by the anterior fingers **59** and **60** of the triggers **4** and **5** acting on tooth **61**, which is pushed outside with respect to the swinging lever **56** by a spring **62** in such a way as to allow the free passage from downward upward of the fore ends of the fingers **59** and **60**, but to be engaged with such ends when these are moving from upward downward. Each of the fingers **59**—**60** may act independently from the other on the tooth **61** causing the lowering of the swinging lever **56** around its fulcrum **63**. The lowering of the lever **56** releases the tooth **54** of the moveable body **53** allowing the striker **51** to run forward under the action of its own spring **52**.

Fig. 13*a* illustrates schematically a second form of realisation of the bolt, in which a striker **64** fulcrumed in **65**, is provided with a lug **66** cooperating with the eyelet **67** of a rod **68**. This rod ends with a body **69** projecting back with respect to bolt **70** and provided with a notch **71** destined to cooperate with a pawl **72** fulcrumed in **73** on the body of the bolt. A spring **74** stresses backward the body **69** in the position shown in Fig. 13*a*. The pawl **72** is provided with a lug **75** projecting out of the profile of the bolt **70**. At the end of the recoil of the bolt **70**, the body **69** meeting a fixed surface on the frame of the arm, enters the bolt **70** and the pawl **72** engages the notch **71** holding the body **69** and consequently the rod **68** and eyelet **67** in the advanced position without however acting on the striker **64**. By acting in a convenient way by means of a trigger on the lug **75** of the pawl **72**, the body **69**, the rod **68**, the eyelet **67** are abruptly displaced backwards while the fore end **76** of the eyelet **67** runs against the lug **66** of the striker **64**, which then abruptly advances hitting the cap of the cartridge. The characteristic of this type of bolt schematically illustrated and described lies in the fact that the spring **74** of the striker is cocked up during the recoil stroke of the bolt, differently from the form of realisation precedently described (Figs. 13—14—15—16) in which the spring **52** of the striker **51** is cocked up only when the bolt **29** advances again.

Another form of realisation of the striker is illustrated in the Figures 21—22—23—24. Also in this case the spring **77** of the striker **78** is cocked up during the recoil stroke of the bolt. The bolt, here indicated by reference number **79** carries a sliding body **80** provided with a tooth (not illustrated) serving for hooking the bolt **79** at the end of its recoil stroke; this body **80** is provided with a pivot similar to pivot **44** of Figures 13—16, transmitting its motion to the lock causing the same to swing angularly around its own axis of rotation; the moveable body **80** is provided with a gripping member **81** serving for the hand movement of the bolt. The sliding body is provided with a lug **83** (Fig. 2) quite similar to the lug **50** illustrated in Figures 13 and 16 on which operates the recuperating spring of the

bolt indicated by reference number 82 in Fig. 23. The body 80 is finally provided with a tooth 84 preventing the striker 78 from hitting the cap by holding it by means of the tooth 85 if the sliding body 80 has not yet reached completely its position of advance and consequently the lock (not illustrated) similar to the lock 25 of Figures 13—16 is not yet hooked on the sleeve 19 of the barrel 1, penetrating into the eyelet 23.

Two guides 86 and 87 direct the bolt in its sliding motion. A tubular prolongation 88 serves as external guide for the recuperating spring 82 of the bolt, which acts indirectly on the lock by pushing a lug 83 of the sliding body 80, this body, as already mentioned, being pivotally connected to the same lock.

The percussion mechanism comprises a striker 78 traversing the whole bolt and ending posteriorly with the lug provided with two teeth 85 and 89 (Figures 21—22—23). On the tooth 85, as already said engages the tooth 84 of the sliding body 80 of the bolt while on the tooth 89 grips the end 90 of the lever 91 applied to the moveable member 93 on which it is fulcrumed in 92. The lever 91 is provided at the lower end with a lug 94 with a tooth 95 destined to engage the tooth 96 provided on the swinging lever 56 already described. The sliding body 93 is provided with a tubular lug 97 provided on its turn with a stopping tooth 98 restraining its stroke backwards, cooperating with a stop (not illustrated) obtained on the body of the bolt. The tubular lug 97 in its back part is slotted upward in such a way that the lug of the striker 78 with the teeth 85 and 89 is allowed to come out. The back part of the tubular lug 97 serves as a guide for the rod of the striker 78.

The tubular prolongation 88 mentioned, solidary to the body 79 of the bolt serves as a guide also for the movable member 93.

The spring 77 of the striker 78 stresses the latter by leaning on its anteriorly thickened part 99, while posteriorly presses against the fore end of the tubular lug 97 of the sliding body 93. This spring 77 is loaded when the sliding body 93 is obliged, owing to the recoil of the bolt and the stop met by the same backward on the frame of the arm to advance with respect to the recoiling bolt and to enter into the seat provided therein. Then the tooth 89 of the striker 78 engages the tooth 90 of the swinging lever 91 and the spring 77 remains under tension to snap then when; owing to the action of the tooth 96 the tooth 95 and the lug 94, the lever 91 swings on the outside around its own pivot 92 causing the tooth 90 to abandon the tooth 89. Then the striker 78 owing to the action of its own spring 77 abruptly advances to hit the cap of the cartridge. The tooth 96 as already above mentioned is solidary to the swinging lever 56, which is lowered by the action of the fingers 59 and 60 of the triggers 4 and 5 on the small tooth 61 of the lever 56.

Also in this case as in the one of figure 13*a* the advantage is obtained that the spring 77 of the striker is loaded during the recoil stroke of the bolt improving thus the conditions of the functioning of the recuperating spring of the bolt which when extending has not to overcome the strength of the striker spring.

The three forms of realisation of the bolt above mentioned may be indifferently used in the shooting gun according to the invention the releasing and percussion control in all the three cases being as follows:

The releasing and percussion mechanism comprises the lever 56 already mentioned, operated on as said by the triggers 4 and 5. A spring 100 stresses the lever 56 to remain in the position illustrated in the figures 2—5—6—7—22—23 and 24 that is raised up and in engagement with its own tooth 55 (or 96) in the tooth 54 (or 95) which, when free, causes the striker to be released as above described.

In the case of the figures 22—23—24 the tooth 96 is carried by a lug 101 of the lever 56, said lug being destined to engage the sliding body 93 in the point 102 as better illustrated in fig. 24. The tooth 96 penetrates into the notch 103 lying over the tooth 95 of the swinging lever 91, without touching the bottom. The lug 101 constitutes therefore a stop for the advance stroke of movable body 93 when this body is stressed to advance by the engagement of the tooth 98 with a stop surface solidary to the bolt 79 above mentioned.

The triggers 4 and 5 (figs. 2—8—9—10—11) are provided inferiorly with the springs to pull off 104 and 105 stressing them to remain in the position of rest around their common axis of oscillation constituted by the passing screw 106. The fingers 59 and 60 of the triggers 4 and 5 are provided inferiorly with the lugs inclined towards the outside 107 and 108 destined to cooperate with the wedge-shaped end 109 of a rocking lever 110 mounted in the block 111 of the frame of the arm by means of a vertical pivot 112. The rocking lever 110 is displaced to the position 110′ when the trigger 4 is lowered with its lug 107 consequently, while it is displaced to the position 110″ when the trigger 5 with relative lug 108 is lowered. The displacement of the rocking lever 110 causes, by means of its own end 113 the sliding of a swinging lever 114 (figs. 2 and 11) along its own axis 115 so that the fore head 116 of the lever 114 is interposed between the head 117 of the rocking lever 118 and the end 119 of the swinging angle lever 120, or between the head 117 of the rocking lever 118 and the end 121 of the swinging lever 122 according to which trigger 4 or 5 has been lowered. The head 116 of the member 114 constitutes a simple transmission member between the rocking lever 118 and the one or the other, at choice, of the levers 120 and 122. The lever 122 is stressed to remain in a raised position, fig. 2) by the leaf spring 123, fixed in 124 on the frame of the arm, while the end 119 of the angle lever 120, fulcrumed in 125, is stressed to remain in raised position (fig. 2) by the same spring 123 acting on the arm 126 of an angle lever whose second arm 127 stresses in left-hand direction the second arm 128 of the angle lever 120. The end 121 of the lever 122 (figs. 3 and 4) is provided with a transversal lug 129 which in the raised position of the lever 122 (fig. 2) holds the cartridge 130 tending to come out of the back magazine 7 of the arm. The end 131 of the swinging lever 126, 127 (figs. 3 and 4) is provided with a transversal lug 132, which in the raised position of the arm 126 (fig. 2) holds the cartridge 133 tending to come out of the fore magazine 6 of the gun. The lowering of the lug 129 allows the exit of the cartridge 130 from the back magazine while the lowering of the lug 132 controls the exit of the cartridge 133 from the fore magazine.

The rocking lever 118 is controlled by the pawl 134 which during the recoil stroke of the barrel 1 acts freely controlled by the same barrel (while it is acted on operatively during the advance return of the barrel. The barrel 1 acts on the up-

per prolongation 135 of the pawl 134 by means of the left inferior surface 136 (figures 18 and 20), provided with an inclined plane 137, a sleeve 19 screwed on the breech 21 of the barrel. When the bolt 29 is closed (fig. 2) the upper prolongation 135 of the pawl 134 is received in the seat provided to that purpose 138 in the forepart of the left side of the bolt.

By pulling down one or the other of the triggers 4 and 5, for instance the trigger 4, the rocking lever 110 is caused to swing around its own vertical axis 112 reaching for instance, the position 110′ (Fig. 10). Consequently there takes place a side displacement of the member 114 sliding on its own pivot 115, the head 116 of said member being brought between the head 117 of the rocking lever 118 and the back end of one of the levers 120 and 122 for instance between the head 117 and the back end 119 of the lever 120. In this manner when the barrel passes from the backward to the forward position illustrated in Fig. 2 and the pawl 134 is consequently caused to swing in the left-hand sense owing to the engagement of its lug 135 with the inclined plane 137 and the surface 136 of the sleeve 19 (Figs. 18 and 20) the rocking lever 118 swings in the right-hand sense around its own pivot 125 (this pivot 125 being common to the rocking lever 118 and the angle lever 120) and with its own head 118 by means of the interposed head 116 of the member 114 pushes downward the end 119 of the lever 120 which on its turn swings in the right-hand sense around the said pivot 125 and with its fore branch 128 causes the raising of the arm 127 of the angle lever 126, 127. This latter consequently swings in the left-hand sense around its own pivot 139, but lowering its own fore end 131 with the transversal lug carried thereby 132. The cartridge 133 (Fig. 4) is then released and under the action of the spring 140 of the fore magazine 6 (Fig. 3) is pushed on the elevator 141 which successively will raise the same cartridge to the position wanted leaning against the top 142 of the back lug 22 of the sleeve 19 already described (Fig. 12).

From the above it may be remarked that by actioning one of the triggers, for instance the trigger 4 while the releasing of the percussion device is determined, and consequently the cartridge being in the barrel is fired the magazine is selected from which, immediately after the shot the new cartridge has to be taken by the elevator to replace the one fired. In the example mentioned, the trigger 4 by displacing towards the left the swinging and sliding member 114 causes the clearing of a cartridge 133 from the fore magazine 6, so that the subsequent shot (which may be fired at choice with the one or the other trigger 4—5) will be fired with the cartridge the shooter has preselected by firing the preceding shot If instead to introduce into the barrel a cartridge of the fore magazine the shooter had wanted to send into the barrel a cartridge of the back magazine he should have fired the first shot by pulling down the trigger 5, so that the swinging, sliding member 114 would have been displaced towards right and the head 118 would have acted, by the interposition of the head 116, on the end 121 of the lever 122 and not on the end 119 of lever 120; in this case the lever 120 would have been stationary while the lever 122 would have swinged in the right-hand sense around its own pivot 143 producing the lowering of the transversal lug 129 and conseqnently the admission of a cartridge 130 from the back magazine 7 under the action of the relative spring 144 to the elevator 141.

In this way the result is obtained that at the instant of firing each shot according to whether the same shot is fired by pulling down one or the other of the two triggers 4 and 5, the magazine is simultaneously preselected from which by lowering down the transversal stopping lugs 129 and 132 a cartridge is conveyed to the elevator for the subsequent shot. Since in the fore magazine 6 there may be disposed cartridges of a certain type for instance of fine lead and in the back magazine 7 there may be arranged cartridges of another type for instance of thick lead, the shooter has the possibility of varying in a practically instantaneous way the kind of cartridge he has to fire, this variation implying obviously the necessary discharge of the preceding cartridge, that is of the cartridge which is already in the barrel.

When the cartridges of a magazine are ended, in order to avoid that the feeding of the arm should cease owing to the actioning of the trigger selecting such a magazine, there is provided according to the invention a member sensible to the presence of cartridges in the magazine, which as soon as the magazine is empty, causes the movements of the levers 120 and 122 to be solidary to each other so that the lowering of the one produces the lowering also of the other and consequently in any case the feeding from one of the magazines, where are still cartridges, is secured. In the example here illustrated such a sensible member is only provided for the fore magazine but it is understood that the same member may be provided also only for the back magazine as for both the magazines in a way easily to be determined by the expert who has to teach how to realize the present invention.

The sensible member for the fore magazine 6 is constituted by a finger 145 lightly projecting inside the magazine 6 through a slot 146 and is applied to a lever 147 fulcrumed in 148 on a vertical pivot whose back end 149 is turned downwards and engages a pawl 150 pivoted in 151 on the lever 122 and solidary to a lever 152 normally lodged within a longitudinal groove of the lever 122 but laterally projecting towards the left side of the gun, when the finger 145 under the action of a small spring 153 (fig. 4) penetrates more into the slot 146 owing to the want of cartridges in the fore magazine 6. The lever 152 is then displaced laterally in a position below the end 119 of the lever 120 so that this latter is stressed to be lowered, the member 114 being displaced towards the left, the end 119 causes the lowering of the lever 152 which entrains downwards the lever 122. Consequently the transversal stopping lugs 132 and 129 are simultaneously lowered and the cartridge 130 may advance from the back magazine under the action of its own spring 144.

In order to introduce the cartridges into the arm they are made to pass from the bottom through the lower opening 154, the elevator 141 being thus raised and the cartridge may be pushed by hand into one or the other of the magazines 6, 7.

The elevating moment is quite similar to the one of the usual automatic Browning rifles, that is comprising said blade-elevator 141 and a lateral stop 155 actioned on by the cartridges and externally the knob 156. When it is actioned by hand through the knob 156, the stop 155 has a greater oscillation than when it is actioned on

by the cartridges, consequently it stops with the tooth 157 (fig. 12) the elevator 141 in its upper position. In this case the pressing member 158 (fig. 12) actioned on by a spring 159 is interposed between the stop 155 and the wall 160 of the frame. To this end the rod 151 of the pressing member is provided with a reenforce 162. A simple pressure exercised from downward upward on the pressing member 158 releases the stop 155 (which swings around its own vertical axis 163) and causes it to snap, so that the elevator 141 returns to its position of rest under the action of its own spring 164. The preselecting device above described is completely lodged in the lateral chamber 165 (fig. 21) constituted by the left side 166 of the frame and by the closing lateral plate 8 slidably mounted within the guides 167 and 168.

A safety device comprises the knob 12 (Fig. 3) already mentioned controlling a sliding rod 169 whose fore end 170 cooperates with the posterior lug 171 of the swinging lever 56, preventing the lowering of the same lever when the knob 12 is in a retreated position and allowing said lowering when the same knob 12 is in an advanced position.

The present invention has been illustrated and described in some preferred forms of realisation, but it is understood that numerous constructive changes may be into the examples cited without surpassing the limits of protection according to the present industrial patent.

GOFFREDO PROLA.

PUBLISHED

APRIL 27, 1943.

BY A. P. C.

G. PROLA

AUTOMATIC GUN

Filed Nov. 28, 1939

Serial No.

306,568

6 Sheets-Sheet 1

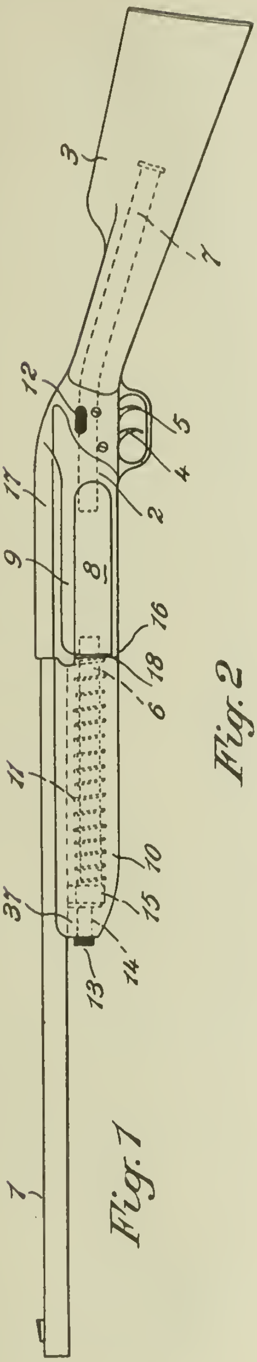

Fig. 1

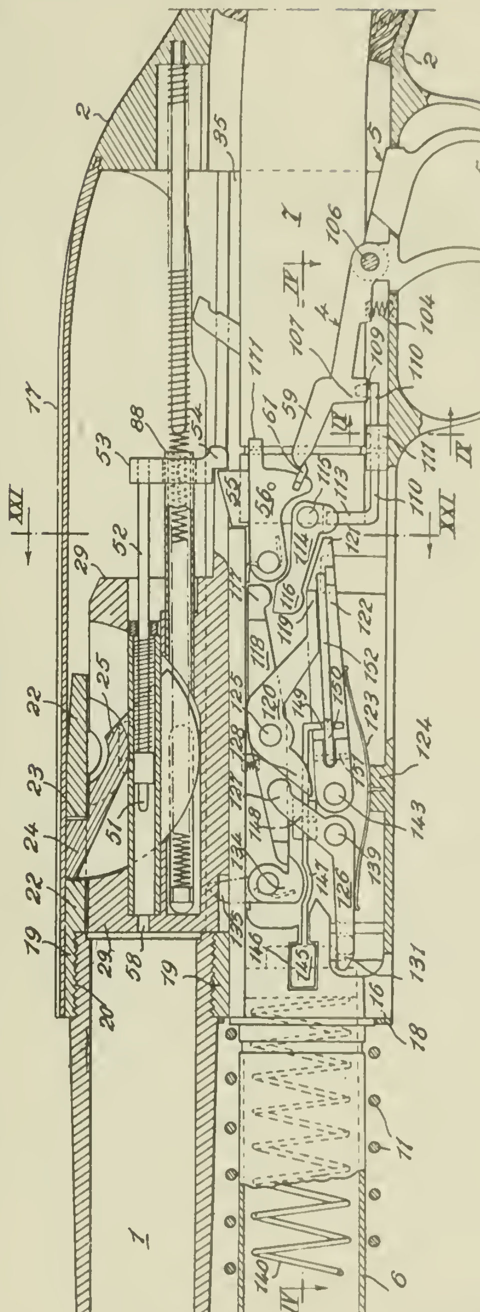

Fig. 2

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PUBLISHED
APRIL 27, 1943.
BY A. P. C.

G. PROLA
AUTOMATIC GUN
Filed Nov. 28, 1939

Serial No.
306,568
6 Sheets-Sheet 2

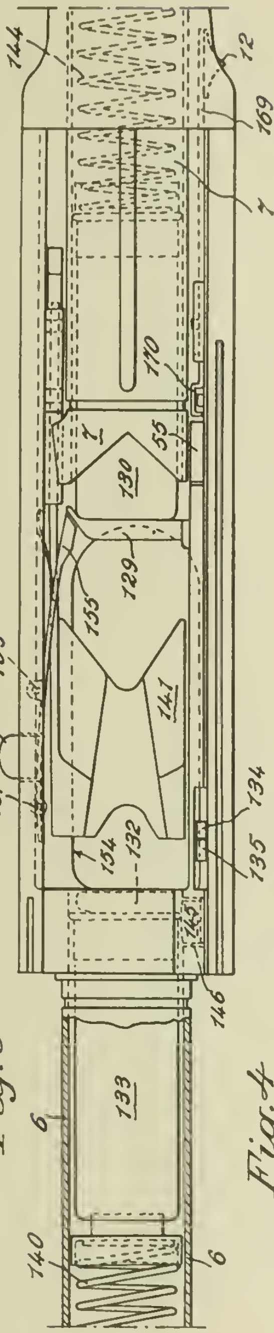

Fig. 3

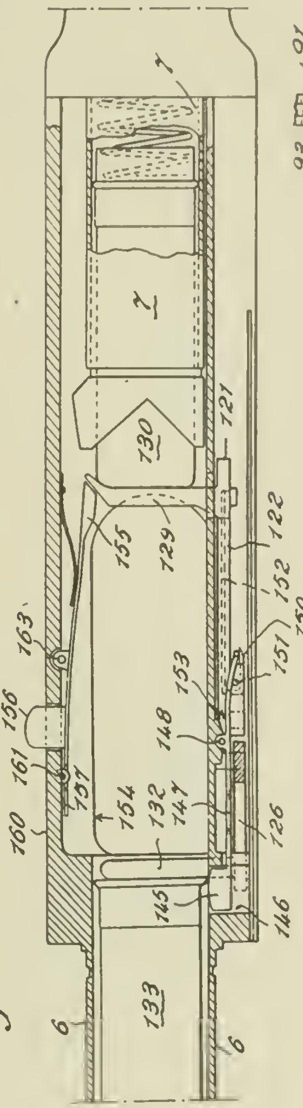

Fig. 4

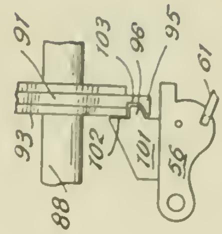

Fig. 24

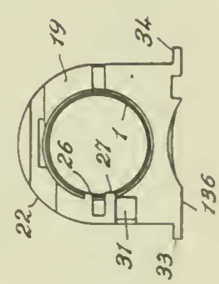

Fig. 20

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PUBLISHED

APRIL 27, 1943.

BY A. P. C.

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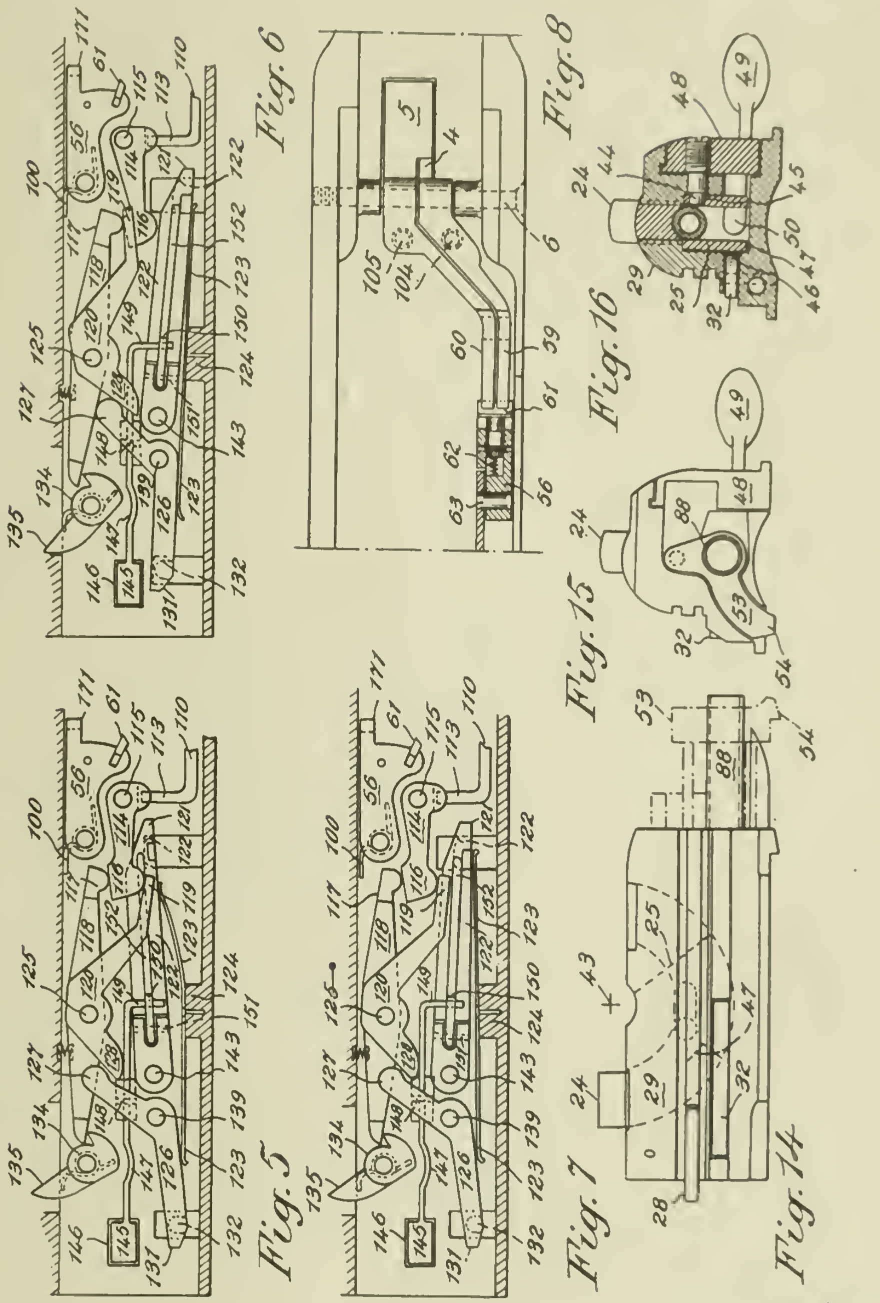
AUTOMATIC GUN

Filed Nov. 28, 1939

Serial No.

306,568

6 Sheets-Sheet 3



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PUBLISHED	G. PROLA	Serial No.
APRIL 27, 1943.	AUTOMATIC GUN	306,568
BY A. P. C.	Filed Nov. 28, 1939	6 Sheets-Sheet 4

Fig. 21

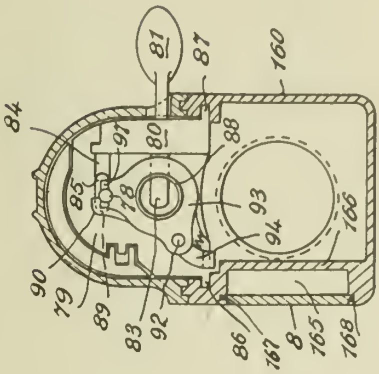


Fig. 27

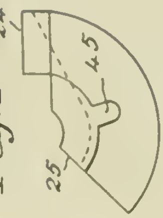


Fig. 11

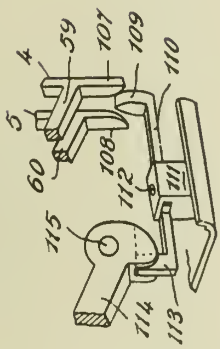


Fig. 10

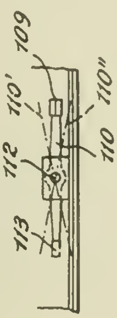


Fig. 26

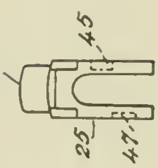


Fig. 9

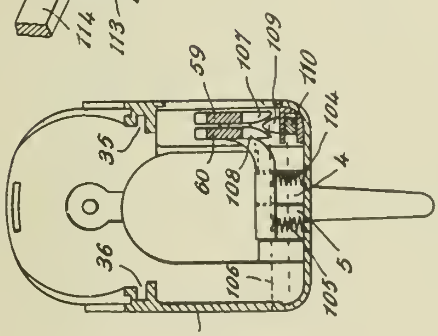
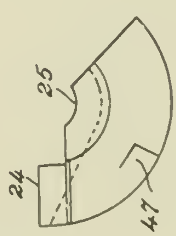


Fig. 25



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PUBLISHED
APRIL 27, 1943.
BY A. P. C.

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AUTOMATIC GUN

Filed Nov. 28, 1939

Serial No.
306,568

6 Sheets-Sheet 5

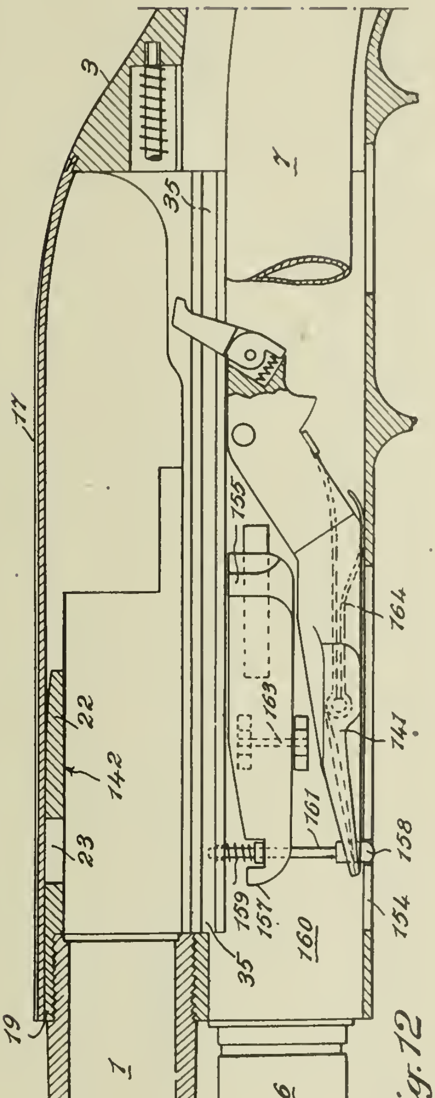

Fig. 12

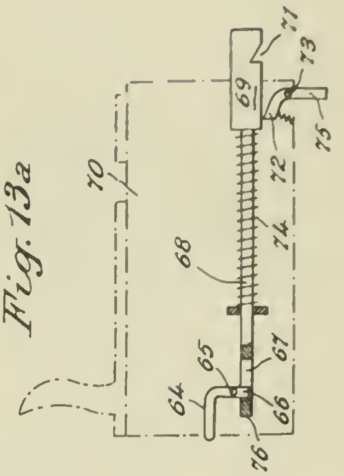

Fig. 13a

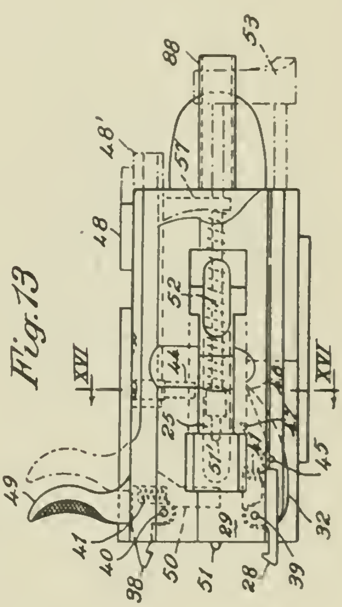

Fig. 13

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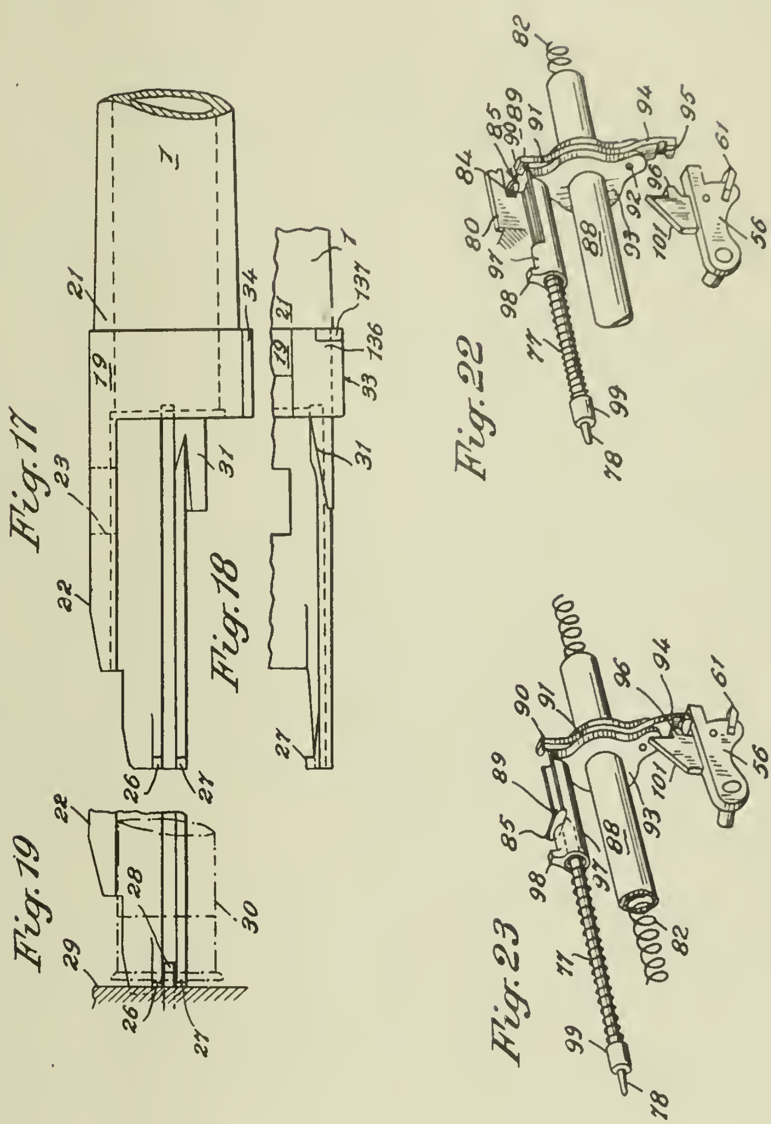
PUBLISHED
APRIL 27, 1943.
BY A. P. C.

G. PROLA
AUTOMATIC GUN
Filed Nov. 28, 1939

Serial No.
306,568
6 Sheets-Sheet 6



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Published Apr. 27, 1943

Serial No. 307,807

ALIEN PROPERTY CUSTODIAN

AUTOMATIC AND SEMI-AUTOMATIC FIREARMS

Josef Koucký, Brno, Bohemia; vested in the Alien Property Custodian

Application filed December 6, 1939

My invention relates to automatic or semi-automatic firearms which have a breech block actuated and controlled by a breech block carrier.

It is an object of this invention to provide for such a weapon of simple construction which is especially suitable for automatic and semi-automatic rifles.

It is another object of my invention to provide for such a weapon which consists of a relatively small number of parts.

Other objects of the invention will appear as the specification proceeds.

According to the invention a recuperator spring is so arranged in connection with the breech mechanism of the firearm as to actuate the movements of the striking member of the firing pin and also to actuate, during the forward movement, the breech block carrier until the locking position of the breech block is reached.

By thus using the recuperator spring for two functions I succeed in obtaining a very simple weapon of precision. Further it is possible to build up the individual parts of the firearm with larger dimensions so that they are less wasted, and the solidity and precision of the weapon are increased.

Preferably the striking member arranged for the firing pin is attached directly to the breech block carrier and is rendered adapted to transmit, during the forward movement, the force of the recuperator spring to the breech block carrier, while the striking member is also arranged for being actuated by the same spring during its striking movement after the end of the forward movement of the breech block. In this manner the action of the striking member is made directly depending on the position of the breech block carrier which controls the movements of the breech block, so that a premature firing with unlocked breech block or a belated firing with prematurely opened breech is prevented, and the safety of the weapon is guaranteed.

According to a modification of the invention the striking member has the form of a lever which, by one end, is hinged to the breech block carrier, while the other end of the lever cooperates, before the forward movement has finished, with a stop about which the lever formed by the striking member tilts so as to recede relative to the breech block, while during this relative receding moveemnt the breech block carrier finishes its forward movement and locks simultaneously the breech block.

The firearm is further simplified if the stop, about which the striking member is tilted at the end of the forward movement of the breech block carrier, forms the sear, which in any known manner is actuated by the trigger with the aid of a connecting rod.

In the drawings affixed to this specification and forming part thereof a rifle self-charging by gas pressure and provided with a tilting breech block is illustrated diagrammatically by way of example as an embodiment of my invention.

In the drawings

Fig. 1 is a longitudinal section through the rifle in the moment of firing a shot.

Fig. 2 shows, on enlarged scale, the cocked striking mechanism before the firing.

Referring to the drawings, **1** is the casing of the breech device, **2** the barrel, **3** the casing of the trigger device and **4** the butt attached thereto. The casings **1** and **3** are connected by means of studs **5** and **6**.

In the casing **1** there is arranged, free for shifting, the breech device consisting of the breech block carrier **7**, the tilting breech block **8** and the hammerlike striking member **9** to which latter is attached, by means of stud **10**, the recuperator rod **11**, resting on an abutment **12** of the recuperator spring **13**. The recuperator spring **13** is arranged in the tube **21** which is held in the casing **3** by the butt **4**. The striking member **9** forms a lever, which is hinged to the breech block carrier **7** by means of the pin **24** and is provided with an extension **23** cooperating with the spring-actuated striker or firing pin **31** accommodated in the breech block. **32** is the extractor for the empty cartridge casings.

The breech block carrier, which possesses a tooth **29**, which in any known manner cooperates with the nose **30** of the breech block **8**, is connected with the piston rod of the gas pressure loading-device (not shown). In the locking position the breech block **8** abuts against a cross piece **34** under which is arranged, free for removal, the ejector **35**, which, during the movement of the breech block **8**, passes through a longitudinal groove provided at the underside of this breech block. The ejector is held in the active position by the spring **37** of the locking lever **38** of the magazine **19**, locking lever **38** forming a triple-armed lever with arm **38'** pressing against magazine **19**, while arm **38''** serves for operation, and arm **38'''** is the support.

41 is the ejector opening, through which the magazine **19** may also be filled with cartridges from belts.

The trigger device comprises the forked trigger **16** hinged to pin **17**. Both branches of this fork

carry at their ends locking teeth 18, which serve for locking the manually cocked breech block carrier 7 during the filling of the cartridge magazine 19 from belts or during an exchange of such belts. The trigger 16 is connected by means of a connecting rod 20, arranged between the branches of said fork, with the sear 21 extending into the slide-way of the end of the striking hammer 23, which projects the breech block. Sear 21 is arranged free for rotation about stud 6 and is loaded by spring 22. The entire trigger device is acted upon by spring 25 which surrounds a guiding bolt 26 passing an aperture in a short arm of the connecting rod 20.

In the casing 3 of the trigger device is arranged a stop 14, acted upon by the spring 15, free for displacement on the connecting stud 5.

The weapon operates as follows:

If a shot is fired off, the pressure of the gases withdrawn from the barrel acts upon the piston which is connected with the breech block carrier 7 and drives same rearwards. During this movement the tooth 29 of the breech block carrier 7 pushes to the nose of the breech block 8 and lifts same out of the locking position, so that the breech block 8 is disengaged of the cross piece 34 and is carried along by the breech block carrier 7 which compresses the recuperator spring 13 via the striking member 9, the recuperator rod 11 and the support 12. Just before the rearward movement has finished, the cartridge ejector ejects the empty cartridge casing through the ejector opening 41. The complete damping of the rearward movement of the breech device is effected by the stop 14.

After finishing the rearward movement the breech device performs, under the action of the compressed recuperator spring 13, the forward movement, during which a fresh cartridge is shifted in the cartridge chamber of the barrel 2. The breech block is continuously engaged with the breech block carrier 7 and is driven forward by same by means of the oblique surfaces shown, while the hammer 9 is entirely turned down, as shown in Fig. 1, with its end projecting the edge of the breech block. Before the forward movement has finished, the projecting end of the striking hammer 9 strikes on the stop formed by the lever-shaped sear 21, which rests by the arm 21′ on the wall of the casing 3. In this moment the striking hammer starts acting as a single-hand lever resting on the sear 21 and is tilted by the force of the recuperator spring 13 in the position shown in Fig. 2. During this movement the breech block carrier 7 finishes the forward movement, during which the sloping edge 42 moves the breech block 8 into the locking position so that it rests on the cross piece 34. The extension 23 of the striking hammer 9 recedes during this movement from the striker 31, and the hammer is cocked. On pulling the trigger 16, the sear 21 is tilted by the action of the connecting rod 20 against the action of the spring 22 so as to release the striking hammer 9 which, under the pressure of the recuperator spring, tilts about the pin 24 until extension 23 strikes the projecting end of the striker 21 and thus effects the explosion of the cartridge. Now the breech block carrier starts its rearward movement, during which it disengages the breech block. During the rearward movement the free end of the striking member 9 slides along the cam face 21″ of the sear, which is tilted against the action of the spring 22. A slit 46, through which passes stud 47 of the trigger, allows the connecting rod 20 to be shifted during this tilting movement. The breech block carrier finishes thereupon its rearward movement, and the whole procedure will be repeated.

The weapon described above and illustrated in the drawing is only an example of the invention, and the details, for instance the arrangement of the breech device or of the trigger device, may be varied in various respects within the scope of the invention.

I wish it to be understood that I do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

JOSEF KOUCKÝ.

PUBLISHED

APRIL 27, 1943.

BY A. P. C.

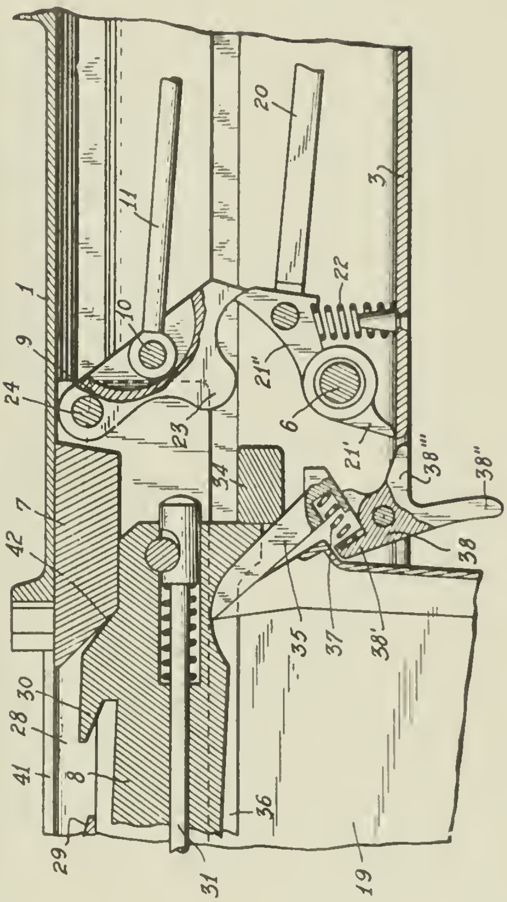
J. KOUCKY

AUTOMATIC AND SEMI-AUTOMATIC FIREARMS

Filed Dec. 6, 1939

Serial No. 307,807

Fig. 2.



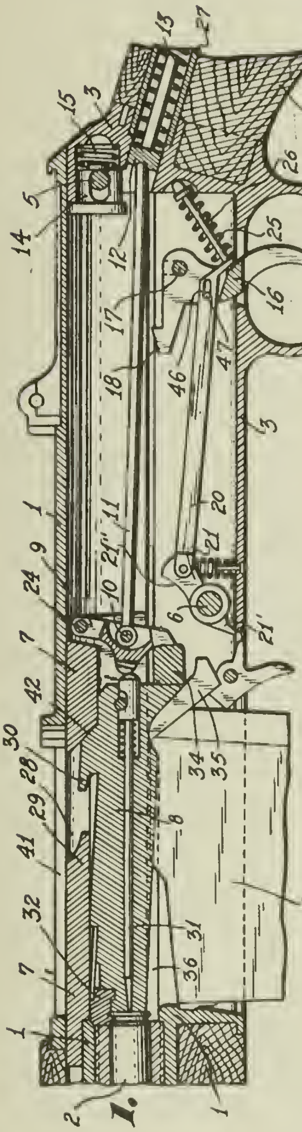


Fig. 1.

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by [illegible]
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Published Apr. 27, 1943

Serial No. 308,027

ALIEN PROPERTY CUSTODIAN

PROCESS AND APPARATUS FOR REFRIGERATION

Julius Faragó, Budapest, Hungary; vested in the Alien Property Custodian

Application filed December 7, 1939

Refrigerator equipments using steam as cooling agent show the drawback, that there are enormous volumes of steam to be sucked away. The high-grade vacuum, needed in consequence of the admissible low evaporating temperatures can not be produced in a single operation by means of the usual mechanical pumps. This vacuum could be produced, of course, by the use of a steam-injector pump, but the total equipment would be thereby excessively enlarged with regard to the great quantities of cooling water required.

Equipments operating by air expansion also must be constructed with large dimensions.

It has been suggested to use the depression caused by the sucking effect of any internal combustion engine in order to intensify the evaporation of the fuel aspirated utilizing thus this cooling effect for refrigeration purposes.

In the process the invention relates to the sucking effect of any engine is used functioning by the aid of air or aspirating it, the cooling agent being not the fuel of that engine so that the process fairly can be applied to machines working without any fuel, e.g. to air-compressors or to engines operating by a liquid fuel without evap)ration e.g. to Diesel motors.

The cooling effect of the process according to the invention is produced by the energy resulting from the difference between the atmospheric pressure and the depression caused by the sucking effect of the air-sucking machine, using a non-combustible cooling agent, e.g. water, air, etc.

The sum of suction volumes of a combustion engine calculated for a certain period, e.g. for an hour, is considerable and effective enough to be used for operating a refrigerator equipment but the efficiency of the engine alone is not sufficient to produce the high-grade vacuum being necessary in a refrigerating process using steam as cooling agent.

According to the present invention therefore the insufficient vacuum produced by the successive strokes of the combustion engine is increased to an appropriate degree by the use of one or more ejector type air-pumps intercalated in the suction pipe of the engine. There is no need to apply air pressure in order to keep the ejectors in action, since the difference between the atmospheric pressure and the depression in the suction pipe is efficient enough to make run the air with high speed into the suction conduit.

If air expansion is used as operating process the expansion and cooling may be produced e. g. in an air-motor. The air-sucking machine maintains, like the process of evaporation of water, a depression in the suction pipe and the atmospheric air running into the air-motor annexed to the suction pipe expands to the degree of that depression. The output of work of the air-motor can be utilized for several purposes, e. g. to increase the effect of refrigeration by raising the difference in pressure using an air-compressor or to increase the pressure in the working cylinder of the combustion engine, etc.

Preferably not the whole suction stroke of the combustion engine is used for the production of vacuum; it seems to be advisable to close the junction to the refrigerator attachment on a certain point of the suction stroke and to supply atmospheric air into the working cylinder of the engine during the further course of the suction stroke by opening an aperture sucking air from the atmosphere. Thus the engine is supplied with the whole amount required for the combustion process.

The accompanying drawing shows two examples of embodiments of an equipment to carry out the process according to the invention in which

Fig. 1, shows a view of arrangement working by evaporation of water and

Fig. 2, shows a view of an arrangement working by the expansion of air.

According to Fig. 1, the evaporator **1** is attached through the conduit **2** to a machine producing work for any purpose e. g. to the working space of a four-stroke combustion engine **3**. Between the valve **7** and the working space of the engine **3** a suction pipe **9** furnished with the valve **8** is arranged leading to the atmosphere. The valves **7** and **8** are operated by the engine by means of a gear represented in this Figure by the lever **6**. The water is supplied into the evaporator **1** continuously or by portions through the pipe **5**. The conduit **2** is fitted with ejector-type air pumps **4** taking air in from the atmosphere.

At the beginning of each suction stroke of the engine **3** valve **7** is opened and valve **8** is closed. The suction thereat is effected through the pipe **2**. In the evaporator **1** and in the conduit **2** consequently depression is produced evaporating the water in the evaporator **1**.

The heat of evaporation is taken from the surroundings, whereby a cooling effect takes place.

The vacuum thus produced by the engine is not effective enough to evaporate the water in the evaporator **1** at an appropriately low temperature. For this purpose the vacuum must be raised by the aid of the air jet pumps **4**. In con-

sequence of the pressure difference between the atmosphere and the pipe **2** air streams at a high speed through the ejector type mouths (not shown in the drawing) of the air jet pumps **4** into the pipe **2** and an intensive suction is produced in all parts of the conduit lying behind the mouths.

During the further step of the suction stroke of the engine the valve **7** is closed and valve **8** open taking in so the missed quantity of air from the atmosphere.

In the conduit **2** the pressure equalizers **10** are arranged and the water condensed in them can be led away.

Fig. 2 shows an air motor **12** the outlet opening of which being connected by the conduit **13** with the air inlet opening of an internal combustible engine **15**. The pipe **13** refrigerates the brine or an other cooling agent. Atmospheric air is led to the air motor by the pipe **11**. Near to the stroke end of the piston **17** of the engine **15** there is provided an air inlet aperture **16** having a valve opening toward the inner space.

At the beginning of each suction stroke of the engine **15** air is taken in through the pipe **13**. In consequence of the difference in pressure between the pipe **11** open towards the atmosphere and the pipe **13** the air streaming in expands in the air motor **12** and becomes cooled. The expansion of the air at the same time operates the air motor. During the following step of the suction stroke of the engine **15** the valve **14** is closed whilst the piston **17** opens the aperture **16** and the working space becomes filled with air of atmospheric pressure.

An air compressor operated by the air motor **12** can be used in order to increase the pressure in the pipe **11** above the atmospheric pressure, increasing so the difference of pressures in the air motor, the vacuum produced by the engine **15** being so further increased.

In the case of supplying liquid fuel into the pipe **13** used in any internal combustion engine, e. g. in a gasoline motor, the heat needed for the evaporation of the fuel is also taken off from the space surrounding the pipe **3**, i. e. from the space or agent to be cooled.

The process and equipment described shows advantages namely in connection in a multicylinder engine or combined with more engines.

JULIUS FARAGÓ.

PUBLISHED | J. FARAGÓ | Serial No.
APRIL 27, 1943. | PROCESS AND APPARATUS FOR REFRIGERATION | 308,027
BY A. P. C. | Filed Dec. 7, 1939 |

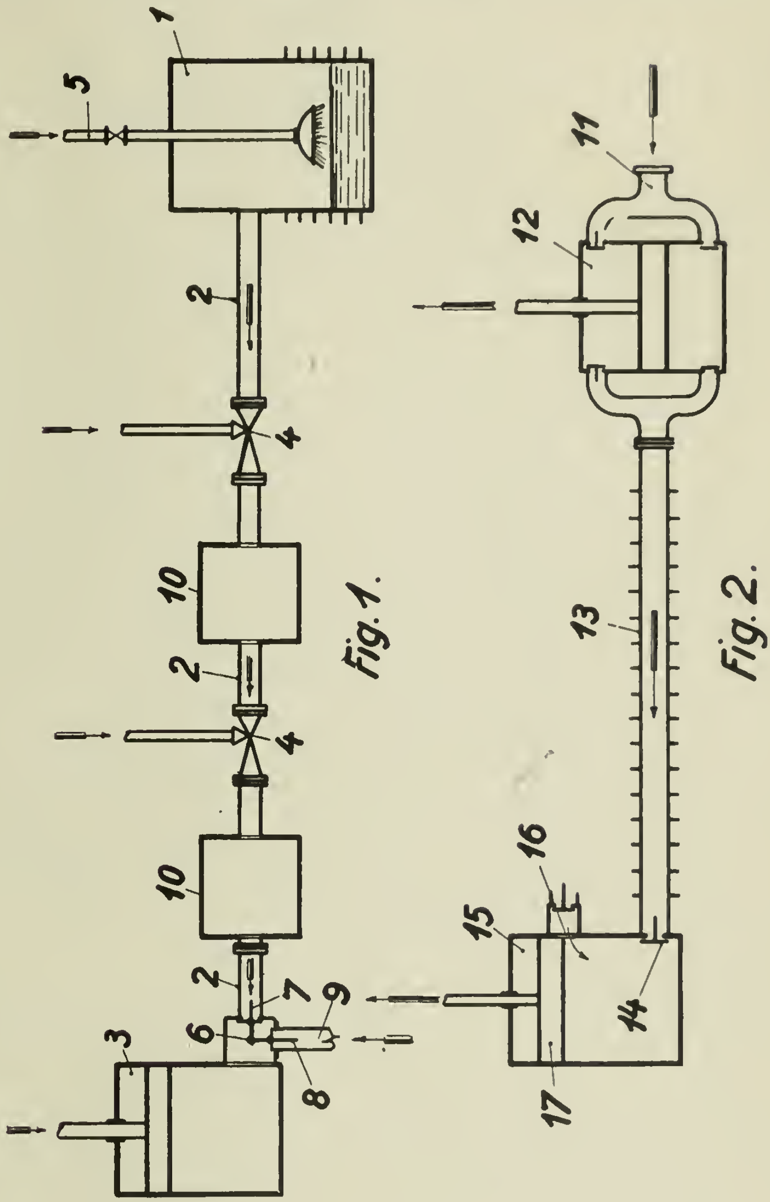

Fig. 1.

Fig. 2.

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Published Apr. 27, 1943 Serial No. 308,140

ALIEN PROPERTY CUSTODIAN

METHOD AND TOOL FOR CUTTING THREADS

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Application filed December 8, 1939

This invention relates to a novel method and a new tool for cutting threads.

The known methods and appliances for cutting threads, for example, on a lathe, includes a cutting die for outside threads and a tap for cutting inside threads. The milling or grinding of threads is usually carried out in separate operations on special machines. The die and tap tools have limitations regarding costs and accuracy, particularly in the case of threads of relatively large diameter, and their use is further limited by the shape of the work piece on which the thread is to be cut. For example, a die cannot be successfully used in the case of a work piece having a flange or other enlargement disposed adjacent the thread portion. It is necessary in such cases to resort to the use of special thread cutters, even where the relatively high accuracy, which can be obtained with such cutters, for example, with single tooth cutters or the like, is not required. The disadvantage of such thread cutters resides in the time factor: more time is required to provide a thread with a thread cutter than with the other customary tools.

One of the objects of the present invention is to provide a new thread cutter and a method for cutting threads therewith in a considerably shorter time than was possible heretofore and with a higher degree of accuracy than can be obtained by using dies or taps of known structures.

The drawings illustrate an embodiment of the invention.

Reference character *a* indicates a work piece provided with an enlargement or flange *d* which excludes the efficient use of an ordinary die or the like for cutting a thread on the section *b*. The thread may be cut with the new thread cutter c to obtain the previously mentioned advantages.

The new thread cutter *c* may be made in the form of a round formed tooth provided with a plurality of cutting teeth which are axially spaced from each other in the illustrated embodiment by twice the pitch of the thread to be cut. This spacing, however, is not to be considered as an absolute rule; different spacing of the teeth may be adopted.

The cutting procedure may be generally similar to the one used with known thread cutters; that is, the cutter is successively adjusted so as to cut to a certain depth and is repeatedly carried after each depth adjustment lengthwise of the thread portion *b* until the desired thread is finished.

The known thread cutter having one or several teeth and operating according to this general procedure requires to be carried over the entire length of the thread, the first tooth taking care of the precutting and the other teeth successively finishing the thread, thus necessitating an axial path relative to the work piece which exceeds the length of the thread. The new method and tool disclosed herein depart from this procedure. The cutting teeth are identical as to form and shape, and the tool is moved axially relative to the work piece regardless of the length of the thread over a distance which is substantially equal to or only slightly greater than the distance between its cutting teeth, which may be the space corresponding to the distance determined by the pitch of the thread or any desired multiple thereof.

The cutting path of the tool becomes smaller with the increase in the number of its cutting teeth provided on a cutter of a given width. In the illustrated example showing a thread cutter with teeth spaced by twice the pitch of the thread, the cutter will move axially relative to the work piece over a distance slightly exceeding double the space of the pitch. Accordingly, the work piece must rotate slightly more than through two revolutions in order to cut the required thread. The initial position of the cutter is fragmentarily indicated in dotted lines and its end position in full lines. The resulting space indicates the relative axial operating motion which is substantially equal to the distance between the teeth of the cutter. The shortest cutting time is reached, provided the thread is not prohibitively long, by using a thread cutter made according to this invention and providing thereon teeth spaced by a distance substantially equal to the pitch of the thread. Each tooth will then cut only part of the thread, or a distance which is substantially equal to the pitch of the thread, and the work piece has to go only through a little more than a single revolution.

In this new method using, for example, a tool with a width which corresponds substantially to the length of the thread, the cutting path is wholly independent of the length of the thread and is, in the illustrated embodiment, only slightly greater than the distance between two cutting teeth. According to the cutting of the thread and the division or distribution of its teeth, one-third, one-half or all of the threads are cut simultaneously, rendering a very economical and efficient procedure.

The drawings illustrate particularly the cutting of outside threads. It will be understood, however, that the principles discussed are likewise applicable to cutting inside threads by means of a tool conforming in structure and use to the one which is specifically described and illustrated herein.

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PUBLISHED
APRIL 27, 1943.
BY A. P. C.

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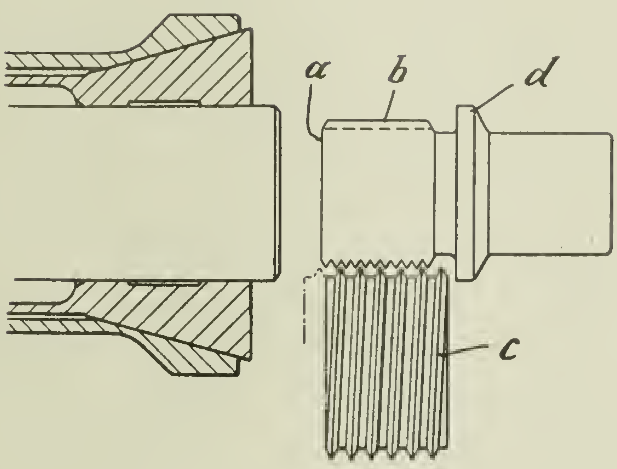
METHOD AND TOOL FOR CUTTING THREADS
Filed Dec. 8, 1939

Serial No.
308,140



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